The Builder.

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The Proposed Nicaragua Canal.

OF late years so much attention has been paid to the progress of the Panama Canal that the consideration of the rival scheme, the subject of this article, has been comparatively neglected. The United States Government have from time to time caused official surveys to be made across Nicaragua with the view of constructing a canal from the Caribbean Sea to the Pacific Ocean through that country, and we will now endeavour to describe the results achieved.

The general direction taken by all the surveys is from Greytown on the Caribbean Sea to Brito on the Pacific side, taking advantage of the Rio San Juan, Lake Nicaragua, one or two minor streams, and the Rio Grande. They vary considerably, however, as to the methods of constructing the canal, as well as in important details of the line of route. Every scheme comprising the main construction must necessarily have Lake Nicaragua as a summit level of the canal, whilst the Rio San Juan being the outlet of the lake (on the eastern side) must also be largely utilised. The lake is about ninety miles long and from thirty-five to forty-five miles wide, and in the rainy season of 1878 its surface attained an elevation of 110 ft. above the mean level of the sea, which is no doubt a fair maximum. From this it will be seen that a canal without locks is impracticable. The chief points to be attended to, then, are how to convert the Rio San Juan into an arm of the lake in such a direction as to obtain the smallest number of locks, with as little expense, and in as short a distance as possible, on the one side; and as to which of the valleys is to be taken in conjunction with the Rio Grande, with the same objects, on the other.

Col. O. W. Childs, a well-known American engineer, in 1850-51, made the first careful instrumental survey for a canal along this route for the "American Atlantic and Pacific Ship Canal Company."

In 1872-73 Commander E. P. Lull, U.S.N., made a more extended survey, and he proposed that the canal should be made from Greytown, through some small lagoons and hills, joining the San Juan at the junction of that river with the San Juanillo, as indicated by dotted lines on the plan (see next page), and along the valley to Lake Nicaragua, thence across the lake joining the Pacific by means of the valleys of the Rio del Medio and Rio Grande, to Brito. The total distance of the route would be 180·76 miles, of which 61·7 miles would have to be cut. It was proposed to work the canal by means of twenty-one locks with four dams, the length of the summit level being 102 miles, and the estimated cost of the whole 52,577,718 dols.

In 1880 the United States sent another expedition, under Mr. A. G. Menocal, civil engineer, U.S.N., with a view to further examine the ground on the western section from Lake Nicaragua to Brito. The survey of 1872-73, as we have seen, proposed to make the canal by way of the Rio del Medio and Rio Grande. At the same time it was perfectly well known that the Rio Grande could be approached from the lake up the Rio Lajas. No matter which of these two streams were utilised, the position of the nearest lock to the lake, or, in other words, the westernmost extension of the summit level of the canal, would be identical. The deepest cuttings required to reach this point are, by the Lajas route, 43 ft. 9 in.; by the del Medio, 134 ft.; the length of the respective routes being 17·27 miles and 16·33 miles. The estimated cost of the latter route, however, exceeded that of the former by several millions of dollars; but after mature consideration, and by reason of better natural surface drainage (so essential to the stability of a work of this kind, built in a country subject to a large rainfall), the Rio del Medio route was favoured by the surveyors. On this line no watercourse of considerable size would be taken into the canal, and as its watershed is so small, no fears were entertained of damage from freshets. On the Lajas route the conditions were dissimilar. The Rio Grande, which is a mountain stream of extensive and rapidly-inclined watershed and precipitous channel, approaches the canal from the south-east, and turning to the north-east passes through a narrow valley of a width but little greater than that required for the canal. The channel of the river has an average width of 60 ft., and a depth of from 15 ft. to 20 ft. Col. Childs proposed to receive this stream into the canal by a waste-weir, and he estimated its maximum flow at 5,670 cubic feet per second. Mr. Menocal, in the course of his examination of this district, however, shows that the maximum flow may be as great as 10,000 cubic feet per second; whilst it is clear that so large a volume of water could not be received into the canal, at a time when least needed as a feeder, even under the most favourable conditions of flow, without danger to navigation, and to the stability of the works. This was the greatest objection to the Lajas route, and for the time it was deemed almost insuperable.

The principal object of Mr. Menocal's survey was for the special purpose of ascertaining the practicability of turning the Rio Grande into the Lake, thereby leaving the narrow valley now occupied by its channel across the divide, free for the construction of the canal. This was shown to be quite possible by making a dam across the river and cutting an artificial channel for it into the basin of the Lajas, as shown on the plan Furthermore, this survey showed the expediency of cutting an artificial channel near the mouth of the Lajas in such a position as to cause the waters of that river to enter the lake about one mile south of its present mouth, thus leaving its bed at this point free for the canal.

The head-waters of the Rio Grande having been disposed of, it is evident that provision must be made for its tributaries. Of these, it is proposed to receive the Espinal (just above the highest lock) into the canal by means of a waste-weir. The other streams would be allowed to empty themselves as at present into the main channel, but in some cases where it seems advisable the canal would cut across sharp curves of the river, and artificial channels would then have to be made to accommodate it. It is proposed to pass some small brooks from the northward under the canal to the river. Seven waste weirs are to be constructed at suitable points for the discharge of surplus water. The survey of 1872-73 proposed to overcome the difference of level between the lake and low tide at Brito by making eleven locks; whilst that of Mr. Menocal provides only four locks, as will be seen on the plan. The lifts proposed are as follows:—For lock No. 7, a variable lift of from 24·2 ft. to 33·18 ft., depending on the state of the tide; for No. 6, 29·7 ft.; for No. 5, 29·7 ft.; for No. 4, 26·4 ft. The estimated cost of the work, following out Mr. Menocal's scheme, is much less than that by way of the Rio del Medio. The survey of 1880 in the main confirmed that of 1872-73 in regard to harbours at either end of the canal, about which there seems to be no serious difficulty.

In 1885 Mr. Menocal was ordered to make another survey, the operations of which were to be confined to the re-location of the eastern section of the canal. Two important modifications of the location of the 1872-73 survey were contemplated, either of which would, if found to be practicable, shorten the distance very materially, simplify the engineering problem by the elimination of sharp curves and by a reduction of the watershed that had to be provided for by the old location, and diminish the cost considerably.

One of these changes consisted in the construction of a dam just below the confluence

of the San Juan and Sarapiqui, by which 22¾ additional miles of the San Juan could be made navigable, and the actual canal excavation from the dam to Greytown reduced to about 21 miles through a comparatively level country. Col. Childs had proposed to raise the waters of the river about 14 ft. by the construction of a dam at that point; and later, in 1879, M. Blanchett, an enthusiastic Frenchman, had proposed to convert the river above that point into an extension of the lake by the construction of a dam, 74 ft. high, at the same place.

The other proposed change consisted in taking a line from Greytown direct to the valley of the river San Francisco, and through this valley to the San Juan, instead of joining that river near its confluence with the San Juanillo. The alteration would, of course, necessitate cutting through the divide between the valleys of the San Juanillo and San Francisco.

The first-mentioned project failed; for a hill on the right bank of the San Juan, which at first seemed favourable enough, was shown to be surrounded by swamps, and not connected with a continuous range into the interior; whilst on ascending the Sarapiqui for 10 miles no high land was found on either side. It was, therefore, discovered that to raise the water of the San Juan by a dam at that point, as had been so often proposed, was impossible.

The second project fared much better. A systematic survey was carried up the Rio San Francisco and its tributaries leading eastwards, with a view to finding the easiest pass across the divide. About three miles from the San Juan that river divides into two branches; the main stream takes a north-westerly direction through a broad and comparatively level valley confined by two ranges of hills, the elevation of the river being about 60 ft. above the sea, having a mean width of about 50 ft. between its clay banks, and a flow in the dry season of not more than 100 cubic feet per second. The other branch, or tributary, runs in an easterly direction through a wide level valley, and in its course receives two or three small creeks. A great deal of attention was paid to this district. It was previously entirely unknown, even to natives. Much of the work was carried on in wet swamps, where travelling was fatiguing in the extreme, officers and men being compelled, in many instances, to go over long distances buried to the waist in mud and water, with a very uncertain bottom to stand upon. At the summit of some of the elevations, high trees were climbed, in order to obtain a view of the country and make sketches of the high ranges surrounding the valley, and in Mr. Menocal's report he states that this method of obtaining information as to the topography saved much labour, and contributed in a great measure to the favourable results accomplished by the party. He suggests that in making an extensive and detailed topographical survey of that region, where the engineer can only ascertain what lies 10 ft. ahead of him by cutting his way through the dense vegetation, the construction of towers of observation on several prominent points, and perhaps reconnaissances by balloon, would be the means of obtaining readily, and at comparatively small expense, information which would require, by the system he was compelled to adopt for want of other means, many months of arduous labour.

At length, a suitable way was found across the divide, and the line advanced over it and down the precipitous eastern slope, where a river valley fortunately was found trending for some distance in the direction of Greytown. The elevation of the divide between the western and eastern flowing waters is 280 ft., but as it was found impossible to plan the canal so as to conform to all the turns of the valley, the proposed line cuts several spurs which rise a number of feet above this height. The amount of blasting and excavation required at this point is very considerable, and forms the most expensive item in the estimates; 7,760,312 cubic yards of solid rock must be excavated, the cost of which is estimated at 11,640,468 dollars.

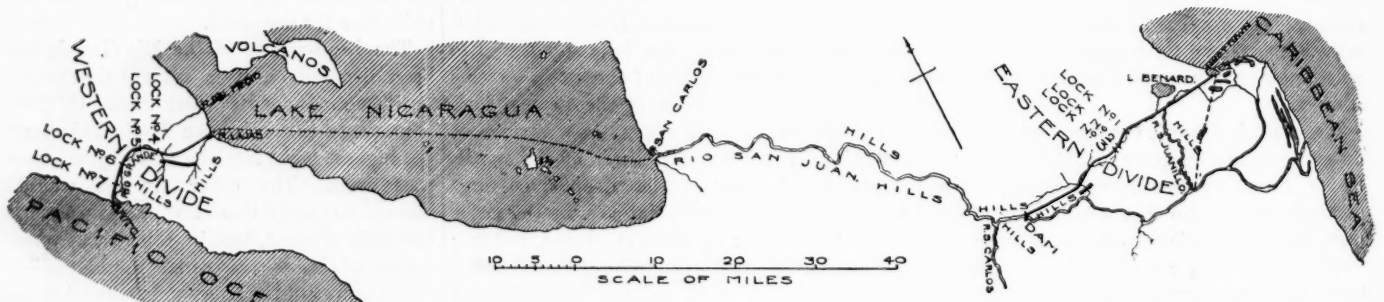
On the eastern slope of the divide, it will be necessary to have a lock (No. 3 on plan). This is the highest lock proposed by the scheme on going from the lake towards Greytown; the summit level of the canal, therefore, is to be preserved from lock No. 4 on the western section to lock No. 3 on the eastern, a distance of 144·8 miles. In order to maintain this level, however, several considerable works have to be executed, the three most important of which are: (1) the construction of a dam across the San Juan, so as to raise its waters to the required height; (2) the cutting through the hills which divide the San Juan from the head of the valley of the San Francisco; and (3) the erection of an embankment across the San Francisco between the place where that stream receives its main tributary and the San Juan.

The site of the dam was fixed at a suitable spot sixty-four miles from the lake (as shown on plan) between two opposite steep and rocky hills, extending on either side to the mountains in the interior. The dam is proposed to be 52 ft. in height, and it will convert the upper valley of the San Juan and that of the San Carlos (a tributary) into an extension of Lake Nicaragua. The valleys of the San Francisco and its chief tributary will also be filled with water, as the hills above alluded to can easily be cut through, and it will be equally practicable to construct the embankment across the San Francisco. The last-mentioned work is proposed to be 6,500 ft. long on the crest, and 51 ft. maximum depth. It having been shown to be possible to extend the summit of the canal to Lock No. 3, the only remaining difficulty is to get rid of the drop to the tide level of the Caribbean Sea. This, Mr. Menocal says, can be done by making three locks, as shown. The drops of these are as follows: — For 26 ft. From Lock No. 1 to Greytown the Lock No. 3, 53 ft.; for No. 2, 27 ft.; for No. 1, canal would pass across the flat basin of the San Juanillo, cutting that stream in several places, and the swamps of the lagoon region. An artificial channel must be cut, south of the canal, to divert the San Juanillo, and another, north of it, to give the Benard lagoon and its tributaries an independent outlet to the sea.

We have now traced the route as proposed by Mr. Menocal from the Pacific to the Atlantic. Its total length is 169·8 miles, of which 38·98 miles are to be excavated canal and 130·82 miles navigation by Lake Nicaragua, the Rio San Juan, and the basin of the Rio San Francisco; and there are to be seven locks. The time required for a vessel to pass through from Greytown to Brito is estimated at thirty hours. The minimum radius of canal curves is 4,000 ft. Provision has been made for illuminating the route by electricity, wherever necessary, so as to insure its safe navigation at night. With ample water power at several points this can be done with but little expense. In 22·37 miles or 57 per cent. of the canal in excavation the prism is large enough for vessels in transit to pass each other; the remaining distance in which large vessels cannot conveniently pass is so divided that the longest is only 3·67 miles in length. The daily water supply is much in excess of that actually required for working the canal. A railroad will be constructed from Greytown to the dam across the Rio San Juan, and between the Lake and Brito.

The estimated cost of the whole is 64,036,197 dollars, which includes 25 per cent. for contingencies and many minor expenses which we have not alluded to. The estimates of the survey of 1872-73 calculated on the same basis and deducted shows a difference in favour of the location of 1885 of 16,921,980 dollars.

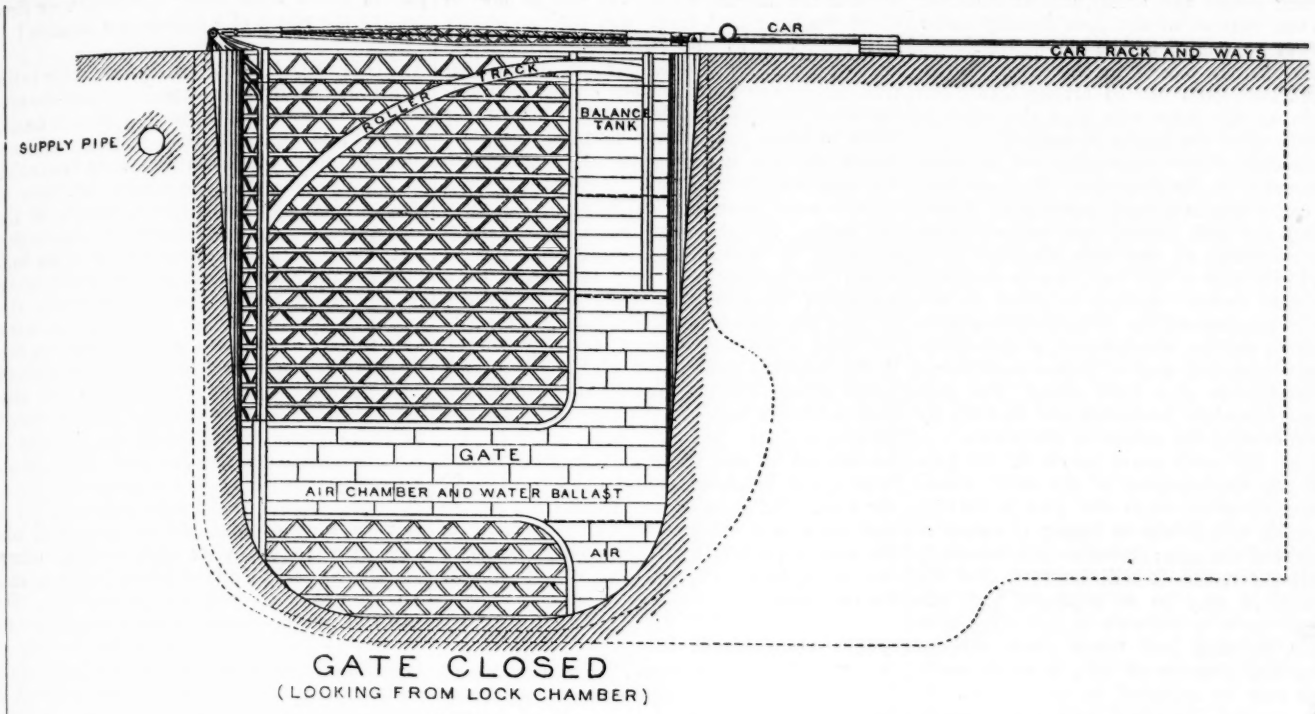
The accompanying diagrams represent the designs for the tail-gate of Lock No. 3 of the proposed Nicaragua Ship Canal following out the scheme of Mr. A. C. Menocal in his Report of the 1885 survey. At first he intended to recommend iron sliding gates for all the locks, but for the one in question which, as we have seen, is proposed to have a lift of 53 ft., such gates would not answer. The tail-gate of this lock, with a total height of 88 ft., of which 58 ft. would project out of the water when the lock is empty, required additional provision to counteract possible wind pressure and guide it safely across the chamber. Some difficulty was experienced in settling this point, but eventually Mr. R. E. Peary, Mr. Menocal's principal assistant in the survey, suggested a rolling



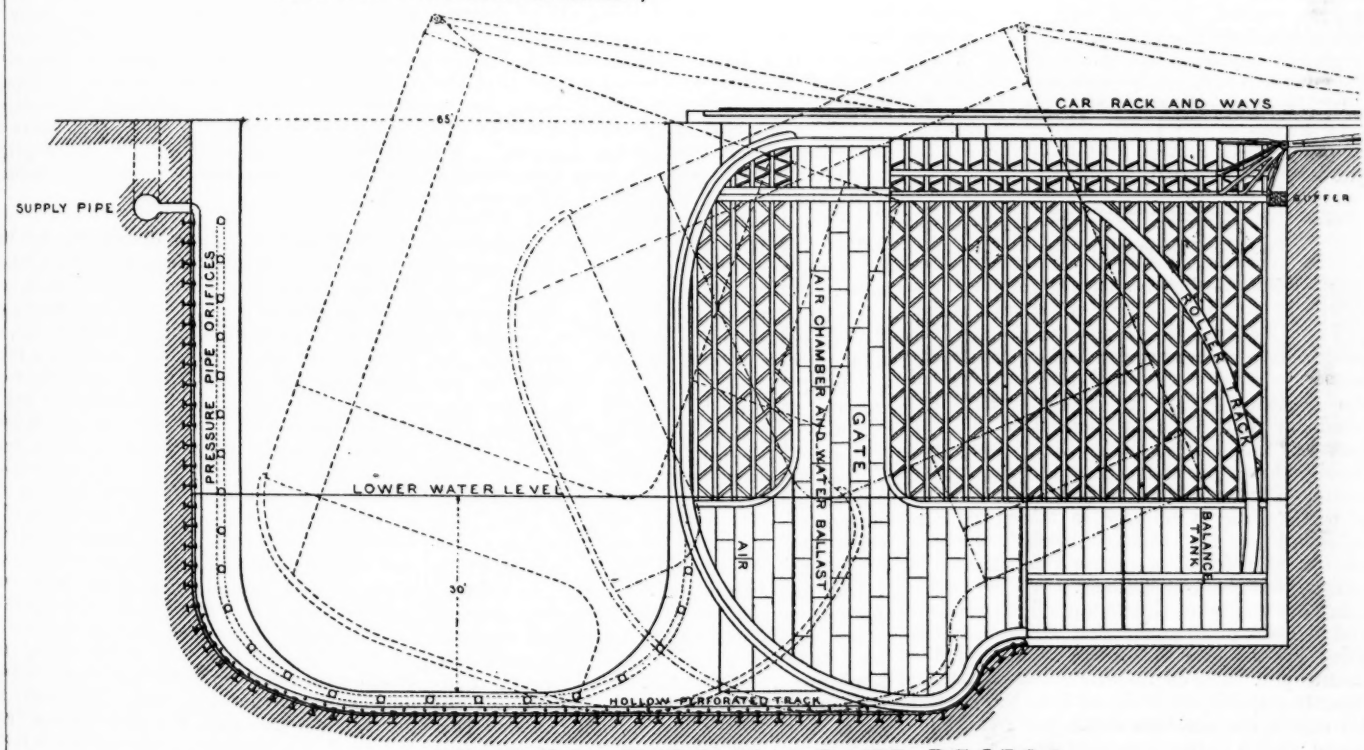
gate which seems to fulfil the requirements of the case.

In describing this Mr. Menocal says that the principal device consists of a rolling or tumbling gate; a lateral recess in one side of the lock-chamber into which the gate retreats when opened; rails upon which the gate travels; a car spanning the recess and travelling backwards and forwards upon a track laid on the top of the lock; and a rod strut, or pivoted truss, connecting the car with the gate. In shape, the gate may be described as a rectangular upper portion resting on a curved lower portion, the inner or rear part of this curve being a quadrant of a circle of such radius that the length of the arc of the quadrant is equal to the width of the lock, so that the travel of the gate in rolling through 90° will carry it entirely within the gate recess. The lower part of the gate, to a point 1 ft. or 2 ft. above the lower water-level, and the inner or rear side of the gate will be built as a water-tight compartment, to contain a shifting water ballast; the remainder of the gate being open trusses, plated on the down-stream side; the centre of gravity being kept by this means near the centre of the arc on which the gate rolls, and the balance more perfectly maintained. The gate travels preferably on rails raised above the floor of the lock in order to prevent any accumulation of foreign materials upon their surfaces.

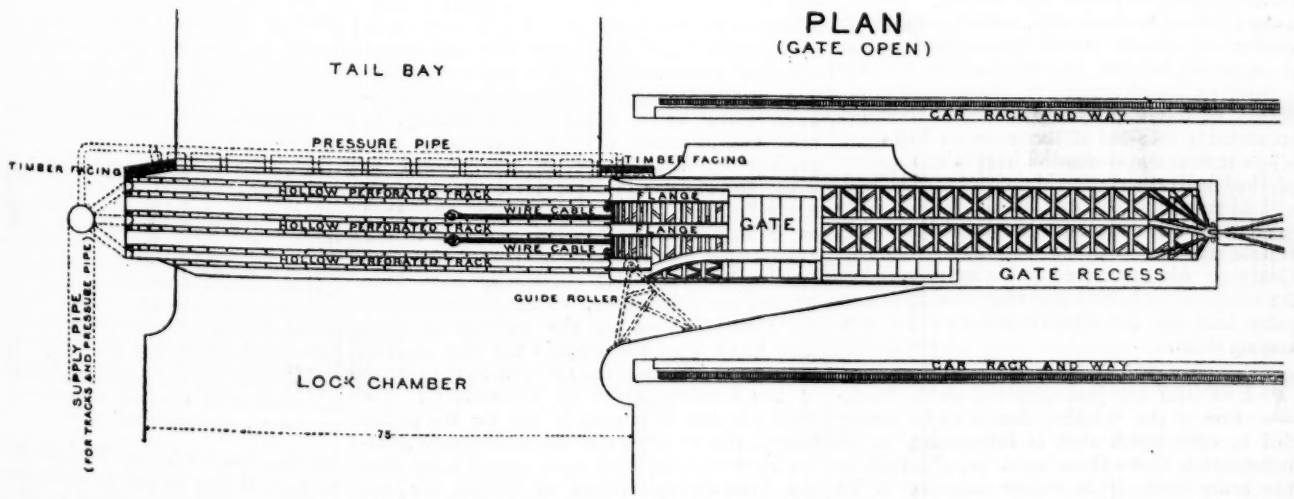
Flanges upon the curved bottom of the gate prevent any lateral movement, and any possibility of slipping backward or forward during manœuvring is precluded by four chains, each equal in length to the arc of the rolling quadrant, arranged in pairs, one pair being attached at one end to the gate at the upper extremity of the quadrant (the



GATE CLOSED
(LOOKING FROM LOCK CHAMBER)



SECTION THROUGH GATE RECESS
(GATE OPEN)



PLAN
(GATE OPEN)

Rolling Lock Gate for Proposed Nicaragua Canal.

b

gate being closed and erect), and at the other end to the bottom of the lock directly under the lower extremity of the rolling quadrant. The other pair is placed in the reverse direction, and both pairs are so arranged that one unwinds at the same rate that the other is wound up when the gate is in motion.

The action of the connecting-rod or truss will be seen from the diagrams. It is attached to the car, which is a rigid rectangular frame, spanning the gate recess, and supported on trucks travelling on two rails placed at right angles to the axis of the lock, one on each side of the gate recess. Motion is given to this car by a compressed air or hydraulic engine situated on the car, which drives a shaft bearing two drums, and each of these drums carrying several turns of a fixed cable. The gate and car are worked backward and forward by simply reversing the motion of the drums.

One of the most novel points in the gate is that the displacement of the lower watertight compartment, when the gate is bearing on the rails, will always be largely in excess of the weight of the gate; therefore it is necessary to admit water, and it will be seen that the amount of it may be so regulated that the gate shall exert a pressure of 5 or 50 tons on the rails, or shall just touch them without exerting any pressure at all; in other words the gate may be adjusted to any weight. It may be worked, therefore, with the expenditure of but little more power than is necessary to give it motion. The minor details of the diagrams will sufficiently explain themselves.

In Mr. Menocal's estimate of the cost of the canal he has simply provided sliding gates for the other locks, though eventually the rolling gate may be universally adopted.

NOTES.

THE verdict of manslaughter against the engine-driver of the train which caused the Hexthorpe disaster was a foregone conclusion for every one who could understand the meaning of the evidence. But it shows astonishing blindness and want of perception on the part of the coroner and jury, that they should have entirely passed over, as a matter not worth comment, the conduct of the Railway Company in taking off the safeguard of the usual "block" working on the very kind of occasion when such a safeguard is above all needed. We have commented strongly on this in a previous number, and we are glad to see that since then the *Times* has also done so in a leading article on the catastrophe. The engine-driver was the person directly culpable, no doubt, as if he had obeyed his orders the accident would not have happened; but a railway company which alters the whole system of working the traffic at the very moment of danger, and takes off the attention of its drivers from the usual system of signals to a temporary and much inferior system (for flags held on the road level are much more easily missed than signals on the ordinary elevated post,—which the driver, besides, knows where to look for), cannot escape the verdict of heavy moral responsibility, and it appears to us to be a matter for legislative interference. A characteristic incident of the inquiry,—what might be called an amusing incident if the occasion had been a less serious one,—was the benevolent speech of the Chairman of the Manchester, Sheffield, and Lincolnshire Railway, Sir E. Watkin, who graciously consoled the relatives of the unfortunate victims with an assurance that his Company did not intend to contest any claims for compensation, well knowing that his Company had not the shadow of a case for contesting them.

A REPORT has just appeared on the condition of the working classes which cannot fail to offer much that is interesting, as all information about them must be, although, at the same time, it is rather negative in its character, and, what is worse, not altogether reliable in what it tells us. The main object of the Report appears to be directed towards the distress which was said to prevail about the time that there was such an outcry last year, and as one parish was as good as another for the purpose, four different industrial districts in London were chosen, containing about 200,000 population. Of course, the whole of these people were not applied to, and out of the rest a good many failed to furnish the necessary information. Altogether, about 29,500 were amenable to being questioned. Of these, 73 per cent. were or had been generally in work, and 27 per cent. out of work, the greater part of them being dock labourers. These latter, indeed, have been worse off than any class of workmen since October 31 last year, when the inquiry was commenced. In the building trade, some of the items look rather formidable, the total of the unemployed dock labourers being 89 per cent., masons and bricklayers 79, painters and glaziers 72, cabinetmakers and turners 61, carpenters and joiners, and blacksmiths and coppersmiths, 29 per cent. Dr. Ogle, of the Census Office, states that there is a marked tendency in many of the answers, especially in the poorer classes, to over-estimate the expenses and under-estimate the resources.

THE Metropolitan Board of Works reassembles this week, after the recess. The *agenda* paper contains a great many items, but only two or three of them are of general interest. Among the communications to be received is a letter from the Strand District Board of Works "expressing a hope that the Board will not permit any building to be erected on any part of the open space at the Piccadilly end of Shaftesbury Avenue." We have already expressed our hope that nothing of the kind will be permitted. After this bit of common sense from the Strand District Board of Works it is the more unpleasant to read the next item on the *agenda* paper, which refers to a "memorial from residents and ratepayers of St. Mary-le-Strand, asking the [Metropolitan] Board to take into consideration the necessity for widening a portion of the Strand by the removal of the Church of St. Mary-le-Strand." It is but just to the Strand District Board of Works to say that the parish of St. Mary-le-Strand is only one of three parishes represented by the District Board, whose collective wisdom will, we trust, outweigh the proposals of the "residents and ratepayers" of St. Mary-le-Strand. We should like to see their names. To refer to another item on the *agenda*, not very pleasant reading to the majority of the Board must be the "letters from the Vestries of Kensington, Camberwell, Shoreditch, Clerkenwell, Paddington, Hammersmith, and Fulham, and the St. Saviour's, St. Olave's, and Holborn District Boards, in favour of the appointment of a Royal Commission to inquire into the Board's past and present system of dealing with surplus lands, &c." We cannot help thinking that the Board would have gained in public opinion if it had consented to the appointment of the proposed Royal Commission a few months ago. To appoint a committee of its own body, as it did, is very much as if it said, "Let us inquire into and report upon our own conduct." We make the foregoing excerpts from the agenda, and supplement them by a running commentary, in full remembrance of the indignation expressed by a member of the Board at what he was pleased to term the "monstrous" conduct of "a paper published on Friday morning" (which answers to our description) commenting, in paragraphs and articles "which must necessarily have been written the day before," on the proceedings of the Board! Does not the member in question know that the *agenda* for the Board's meeting on Friday is always sent to the editors of the London papers on Wednesday? For what purpose is it sent, if not for the public information? Does not the honourable member know that an even more august body than the Metropolitan Board of Works, viz., the House of Commons, issues its "Orders of the Day," "Votes," &c., in advance of its sittings? And did he never read articles in the daily papers based upon those documents, or forecasting the result of a debate or a division?

PROFESSOR CORFIELD, in a letter to the *Times* of the 26th, explains that at the conference of Medical Officers of Health he did *not* say, as reported, that "there was not a medical officer present who was not better able to certify (as to the sanitary condition of houses than any half-dozen members of the Institutes of Civil Engineers or Architects," but that, with the exception of some half-dozen engineers who have paid special attention to the sanitation of houses, any properly-qualified medical officer of health was better able to give an opinion as to the sanitary condition of a house, even as regards its drainage arrangements, than any number of civil engineers. Professor Corfield is good enough to make some exception in his remarks as regards architects, and to admit that they are becoming "alive to the importance of constructing houses that are fit to live in." This is very kind of him, but we must still take exception to the view that medical officers are always and all round better judges of such a matter than an architect or engineer. The medical officer knows in what hygienic state he wishes the building to be, but he is by no means necessarily an equally good judge of the efficiency of the mechanical aids provided to regulate draining and ventilation. Many a specious-looking patent contrivance is brought forward, with all kinds of promises as to what it will do, which to any man of mechanical knowledge shows its inherent weakness at once; and on such a point an engineer or an architect is unquestionably a better judge than a man who has had medical training only.

A REPORT has been drawn up by Mr. Strachan, the able Surveyor to the Chelsea Vestry, on the question of dust collection, and has been printed and circulated, as touching on a matter of public interest. It appears that, in consequence of a number of complaints from inhabitants of Kensal Town about the non-removal of dust, the dust contractor had a special order to clear the dust on certain days from every house in the district, and men were put to check the work done. This supervision disclosed, in the first place, the fact that the contractor had omitted calling at 632 out of a total of 3,180 houses. But the returns of this and of a further and more vigorous collection, when it was proved that every house was called on for its dust, disclosed the fact that for 359 householders who allowed the dust to be removed, no less than 2,549 refused; in round numbers, one in eight saw no necessity for a weekly removal of dust. The answer in many cases was that the dust-bin was "not full yet." The Surveyor proposes that in these circumstances an effort should be made to abolish the brick dust-bin, holding about a cubic yard, and to have zinc covered pails substituted, of such a size as will hold the dust for one week only. The frequent removal would be a necessity then, and the emptying of the zinc pail itself into the cart, instead of carrying out the refuse in separate baskets, would be a much more cleanly method, and give less chance of the scattering and leaving about of unwholesome matter in the process of removal. Mr. Strachan adds the following recommendation:—

"That a few persons be proceeded against before the magistrate for refusing to allow the dust to be removed. By Sec. 126 of the Metropolis Management Act, 1855, a penalty not exceeding 5*l.* is made the liability of every occupier who refuses or does not permit the dust to be removed from his premises when the dustmen call. The intention of this section was to prevent the householder disposing of his dust to any other than the proper dustman, for it had a monetary value in those days. The section, however, is yet in force, and it can be applied to-day to the higher purpose of compelling the removal of the dust for sanitary, if not for monetary, considerations."

"Is that the law?" as Shylock says. If so, we hope it may be put in force without delay, for the good of the subject, in all quarters of London. The oddest point about the matter is that seven persons out of eight, in a whole

parish, should be so foolish as apparently almost to resent the offer to remove from their houses rubbish which is not only a nuisance, but the keeping of which may be even dangerous to their own health, as well as that of their neighbours.

SIR SAUL SAMUEL, Agent-General for New South Wales, has just purchased, for the State House Museum, in Sydney, some interesting and authentic relics of Captain Cook's voyage in the *Endeavour*. Cook gave these to Sir Joseph Banks, who bequeathed them to Dr. Robert Brown. The latter stored them in his Museum, No. 17, Dean-street, Soho, at the rear of, and attached to, Banks's residence in Soho-square. Having lain forgotten during many years in a closed-up cupboard, they were discovered in 1859 by Mr. John Calvert, a subsequent occupant, who bought them, together with other articles associated with Captain Cook and with Banks's domicile here. The house of Sir Joseph Banks, in Soho-square, is No. 32 (formerly No. 30), and now the Hospital for Diseases of the Heart. Subsequently to his death here, on the 19th of August, 1820, it was occupied until 1855 by the Linnæan Society, founded in 1788, who removed hither from Gerrard-street, Soho. Banks and Dr. Solander, a pupil of Linnæus, were appointed naturalists to the exploring expedition under Lieutenant James Cook's command, which sailed in the *Endeavour*, 370 tons, from Plymouth Sound (1768), to make discoveries in the Pacific and South Seas, and to observe the transit of Venus at Otaheite on June 3rd of the following year. The books and herbarium of Linnæus were offered to Banks for 1,000*l*. They were purchased by Sir John Smith in 1784, at a slight advance beyond that sum, on Banks saying he could not afford to seize so golden an opportunity. Banks devised this house to the Linnæan Society. Herein he used to give his week-day breakfasts and Sunday evening *conversazioni* to the Fellows of the Royal Society, whereof he was elected President in 1777, in succession to Sir John Pringle. The name of Banks does not occur in the list of subscribers to "A Voyage to the Pacific Ocean," 1776-80, by Cook and King, edit. 1784; and is not mentioned in that work. The "Mrs. Cook, Mile End-road," is the Captain's widow, then an inmate of the Trinity Almshouses there.

IN the course of the construction of a drain at Rome, from the Piazza della Carrette to the Flavian Amphitheatre, the workmen have discovered two large fragments of a fine marble frieze which is thought to represent a Gigantomachia. The two slabs are published in phototype in the last number of the *Bulletino della Commissione Archæologica Communale* (xv. 8), with an explanatory article by Signor C. L. Visconti. The frieze is undoubtedly of great interest, and of the finest Græco-Roman style, dating probably about the time of Augustus, but we venture to doubt if it represents a Gigantomachia. Since the Pergamene excavations there has been a general tendency to find Gigantomachias everywhere. One of the persons represented is a charming figure of Artemis in short chiton and high boots; she is just in the act of drawing an arrow from her quiver, and the whole pose is closely analogous to that of the "Diana of Versailles," with this peculiarity that the new Artemis is winged. Near her stands a fully-draped matronly figure, with the head veiled. Signor Visconti calls her Gaia, the Earth Mother; but her attitude of complete repose is utterly at variance with the regular tradition of the Gaia of the Gigantomachia, who is uniformly represented as a turbulent and agonised suppliant. At the right side of the first fragment the lower part of a figure remains, and a hand holding a mallet, with which he seems to be cutting at a tree, behind two figures, with torches and excited drapery, evidently Furies or Mænads. We can offer no satisfactory solution to the problem; but Signor Visconti's explanation seems to us not only improbable, but impossible. Influenced by his own theory as to the Gigantomachia, Signor Visconti is inclined to think that the frieze formed part of the elevation of the Temple of Terra, the Earth, founded by the Consul Publius Sempronius, during the war against the Piceni (A.U.C. 484), rebuilt under the auspices of Cicero, 697, and probably again restored by Augustus. Here, again, though the supposition is interesting, anything like proof is wholly wanting.

IN clearing the ground for the new Post-office buildings at Aldersgate it is to be hoped that some efforts will be made to examine, if not, indeed, to preserve, a notable relic of the old London Wall. That structure now stands as the southern boundary of the disused burial-grounds of St. Botolph Without, Aldersgate, and Christ Church, Newgate, which have lately been opened for public recreation. This wall is a portion of the length,—Stow gives its measure as 66 perches,—that lay between Aldersgate and Newgate. It is unquestionably a piece of the City wall. But we cannot agree with the *Times*, which says in a recent article upon "Roman London," that "the line of the City wall was, so far as is known, never changed from the time of its first erection." For the original City wall lay entirely within a later line of defence. Long before London received the honourable style of "Augusta" a strong rampart had been placed around the *Arx* or *Pretorium* which the Romans had planted on the left bank of the Wall brook; and which had Lang bourne to the north and Dowgate and Billingsgate at its southern angles, west and east respectively. This too, be it observed, at a time when the river's northern shore lay further inland than at present. Whether that fortified settlement formed the principal Roman station is open to discussion, since Ptolemy has placed London in the territory of the Cantii, that is, on the southern shore of the Thames. But numerous discoveries tend to show that extensive suburbs had surrounded the citadel by the time of Constantine, and, *teste* Sir William Tite, the later and quite encompassing wall was built during the period 350–369 A.D. Constantius II. and Julian the Apostate were Emperors of Rome in that interval. Circumscribing an area rather less than the 390 acres of Hyde Park, the length of this City wall is variously computed by divers authorities. The return southwards to Mountfitchet (at Blackfriars) from an angle by the present infirmary of Christ Hospital, may be accounted for by the circumstance that here extended the Fleet's steep bluff, along whose elevation the wall was carried. Again, in terms of Edward I.'s charter *ad hoc* to the Black Friars, it was enlarged so as to include the precincts of their Dominican monastery in its south-western limits. A re-entrant angle was made at the present corner of Little Bridge-street and St. Martin's-court, Ludgate, where, until lately, a portion of the re-constructed wall, east and west, remained above ground.

AT the last session of the Berlin Archæological Society Dr. Furtwängler read a paper which should be widely useful to all amateur collectors of antiquities as well as to the professional archæologist. He dealt with the unhappily now widespread fraudulent terra cottas from Asia Minor. With the exception of gems there is, perhaps, no class of antiquities as to which deception is so easy. A certain modernness of style even in the originals makes falsification comparatively easy. Unless, however, the impostor is a well-trained archæologist,—a combination happily rare,—he is sure to blunder in the minutiæ of style, and he is apt to introduce motives which do not appear actually until the time of Renaissance work. Such motives Dr. Furtwängler classifies. They principally occur in schemes of drapery, the shape and decoration of armour and utensils. Further, there is another pitfall open to the unwary manufacturer. He sometimes introduces motives which he knows to be antique, but which from other sources it is ascertained were out of fashion at the time, *e.g.*, Charon and his boat, a motive which had disappeared by the date of the originals. Dr. Furtwängler's long and exhaustive study of terra cottas in connexion with the Sabouroff collection make his opinion of great weight. A report of the paper appears in the Berlin *Wochenschrift*.

CONJECTURE is still busy with the restoration of the Hermes of Praxiteles; indeed, it is a problem of which, till some lucky discovery settles the question, archæologists are not likely to weary. Flasch, in his article on Olympia in Baumeister's last issue of the *Denkmäler des Klassischen Alterthums*, maintains that Hermes is conceived of as cupbearer to the infant god. As such he holds a rhyton, and the little Dionysos a "phiale." The rhyton is natural enough, but the motive of the baby god holding the "phiale" is too formal to be acceptable. We are glad to learn (from the *Berliner Philologische Wochenschrift*, 1887, 38), that Professor Milchoeffer, while he brings his high authority to support the rhyton, disallows the "phiale." Hermes, he thinks, holds the rhyton, the little wine-god leans forward to try and get it, but Hermes seems to say, "Not yet; not yet." There is no pouring out of a libation,—a notion utterly inconsistent with the general conception of the group. A paper by Professor Milchoeffer, in support of his views, is promised shortly.

SOME notable changes have recently been made in the matter of archæological appointments. Dr. Henzen's recently-lamented death left open, perhaps, the most important and influential archæological position in Europe,—the Directorship of the German Institute in Rome. This is to be filled by Dr. Petersen. To undertake his new duties, Dr. Petersen resigns the headship of the German Institute at Athens. This falls,—and the appointment must be matter of universal congratulation,—to the eminent architect, Dr. Dörpfeld. Last, but for the future of classical archæology in England all-important, Professor Percy Gardner leaves the Medal Room of the British Museum to fill the Professorship of Archæology in Oxford, a chair reconstituted since the resignation of Professor Ramsey. There is great work to be done in Oxford, and there are, happily, no two opinions as to whether Professor Gardner is the man to do it.

WE fear that Dr. Lee has not done much good to the cause of economy in Lambeth by his letters in the *Times* against the purchase of land for the proposed Vauxhall Park. We have no doubt he meant well, but it is pretty clear that he has been wrong in some of his facts as to the market value of the land in question. It must be admitted that the fact of a member of the Lambeth Vestry being the owner of the land is, as those in favour of the purchase admit, "unfortunate," and one cannot but think that there has been something "providential," from a Vestry point of view, in the idea of a park at Vauxhall being just now started; but it hardly follows that the purchase of the land and the formation of a park may not be a benefit to the neighbourhood for all that. We imagine it will be so.

THE Richmond and Twickenham Local Authorities, finding that the Thames Conservancy Board refuse to admit the justice of their complaint as to the deplorable condition of the river Thames in their neighbourhood, are organising concerted action for the purpose of promoting a Bill in Parliament for the construction of the often-discussed lock and weir. The Lock and Weir Committee of the Richmond Vestry are now inviting and receiving ideas and proposals from engineers as to a structure which will meet these two conditions,—give the inhabitants in this neighbourhood all the water they desire in the river at low tide, especially during summer; and disturb as little as possible the tidal flow of the river at any period of the year. The contention of the residents of the Richmond district is that, although the recent dredging operations have had the effect of deepening the centre channel, this draws the water from the side shallows and leaves long stretches of muddy banks exposed to view at low tide; and

that these operations have, in fact, been gradually lowering the general level of low tides to such an extent as to expose the foundations of the railway bridge at Richmond. Artists now complain that the river element in the beautiful landscape prospect from Richmond Hill is being destroyed, owing to the narrowing of the stream brought about, not only by the dredging operations, but the filling up of some of the broad reaches, such as that opposite Ham House, with shingle. It is contended that, although all this work is no doubt favourable to the purposes of navigation, the question should be brought to an issue whether the Thames Conservancy Board, in view of the enormous and yearly increasing number of persons who use this portion of the river for purposes of recreation and health, should be permitted to sacrifice the interests of this portion of the community to those of Trade and Commerce. This is, no doubt, a question to be asked. All the engineering authorities to whom we have spoken on the subject are in unison as to the belief that another weir would be detrimental to the tidal portion of the river, by diminishing the "demand," as it is termed, for water, and lessening the scour, and leading to the detriment of the navigable channel in the lower portion of the river; and some, at least, of those who hold this opinion are men of exceptional experience in river engineering. We entirely agree, however, in the opinion that a weir at Richmond would be an immense boon to that beautiful locality in itself, and that the beauty of Richmond is getting seriously deteriorated by the present state of the river; and if it can be satisfactorily shown that a weir can be placed there without injuring the lower river, no one would be more glad to see it than we should.

THERE is satisfaction in noting that our capital city is now, whatever defects still remain, quoted in high (or hygienic) places as a model of sanitary conditions. At the Hygienic Congress at Vienna, Herr Pettenkofer, lecturing on hygienic education and the necessity of spreading hygienic principles among all classes of society, largely quoted English authorities, and in alluding to the English proverb, "Cleanliness is next to Godliness," remarked that the statistics of the mortality of London show how hygienic piety has been rewarded by Heaven. Here is comfort and encouragement indeed for apostles of hygiene, toiling in the narrow way that leadeth unto life.

LETTER FROM PARIS.

THE holiday period in Paris does not take effect, at all events, at the Champs de Mars, where the Exhibition works have proceeded vigorously during the last month. The glass roof of the "Galeries des Exhibitions Diverses" is just finished, and the great machine gallery is now being taken in hand. The footings for the skewbacks of the immense arch-shaped girders are being formed, and in a short time the huge curves of the wrought-iron principals will be rising into the air. On the other side the levelling of the surface of the Champs de Mars is proceeding, in preparation for the plantations and ornamental gardens which will extend up to the terraces of the Palace. M. Alphand, to whom Paris is indebted for the creation of its modern promenades, has undertaken the personal direction of this portion of the works. The Eiffel Tower proceeds, the four iron columns pursuing their parallel course upwards and growing visibly before the eye. Eight hundred tons of metal have already been placed in position. The whole tower will absorb about 6,600 tons, and at the rate at which the work is going, a height of 75 mètres will probably be reached by the end of the year.

In connexion with the Exhibition, it may be mentioned that two architects, M. Lahgée and M. Gilbert, are to submit to the Municipal Council, which has appointed a special committee to deal with it, plans for an "Hôtel International" intended for the delegations of working men who are expected to come to Paris during the year 1889.

We spoke in our last of a grand panorama which M. Alfred Stevens and M. Gervex were preparing in view of the Exhibition. As a pendant to this, M. Castellani, who has made a speciality of this kind of exhibition, has undertaken the production of an extremely complicated panorama, which he entitles "Tout Paris," and which will certainly be one of the curiosities of 1889. It was to M. Castellani that we were indebted for the curious panorama of the "Monde Anté-diluvien," established in the Jardin d'Acclimatation, and which has fallen a prey to fire. There is also an interesting restoration of the Bastille in process of construction near the Champ de Mars, in the Avenue Labourdonnaye, which will include not only the too-celebrated fortress, but also the street and the Porte St. Antoine, and the other contiguous streets, with a faithful reproduction of the houses, shops, and signs of the period. This resurrection of a defunct corner of Paris is being made from authentic documents, and in a most realistic manner.

For some time public opinion has been excited by acts of vandalism of the same kind as that of which Carpeaux' famous group of "La Danse" was a victim some fifteen years ago. If it is the fact that political and religious feeling is the cause of the injuries done to statues in some cases, such as the breakages at Luneville and the hostile manifestations made against the statue of Voltaire recently erected in the Jura, one cannot protest too much against acts which give evidence of a spirit quite at variance with civilisation. But there is a kind of financial vandalism which is quite as annoying in its results, and which has succeeded in spoiling the new St. Lazare railway station. Considering the building at the angle of the Rue de Rome, and seeing the pickaxe employed in the demolition of the long pile of houses bordering the Rue St. Lazare, one hoped, according to the designs of M. Lisch, to see extending along the street a fine monumental façade worthy of the importance of the structure and of the situation. And what has happened? The wealthy company of the "Chemins de Fer de l'Ouest," for whom apparently the æsthetic side of things has no interest, while leaving M. Lisch to build his façade, has decided to raise in front of it, along the border of the street, an immense Terminus Hotel 100 mètres long and 20 mètres high, which will completely mask the station, and present nothing to the eye but an immense square block of stone. The idea of a terminus hotel is a very good one in itself, of course, but it should have been placed at the side, not in the front as it is, to destroy the view of a fine architectural work. It is much to be hoped that the State or Municipal Authorities will interfere, in any future case of the same kind, to prevent such a piece of architectural spoliation of Paris for a mere question of £. s. d.

It is now fifty years that we have been repairing and restoring the Sainte Chapelle, and scaffoldings have masked its beauties for half a century. The limited resources at the command of the Commission des Monuments Historiques chiefly account for this unfortunate delay of the work, the completion of which even now seems still a long way off. We may record, however, a vote of 50,000 francs towards it, which will enable M. Boeswilwald to complete the upper portion before long, when it is to be hoped the Government will see its way to further pecuniary sacrifices.

M. Deck, whose appointment as Director of the establishment at Sèvres we announced recently, has taken a step which has given great satisfaction to all the artists and artisans at work there. Under M. Deck's predecessor they were under a rule of military precision during the whole time they were in the establishment, which they could only enter or leave at regulation hours. This annoying discipline has been abolished by the new Director. "Piecework" is re-established, and the painters and modellers attached to the establishment enjoy from henceforth the liberty they have long demanded, and which is in fact almost necessary to the carrying on of artistic work; and under M. Deck's rule we may expect to see Sèvres a genuine *atelier*, and not a mere "fabrique."

The question of the housing of the Opéra Comique Company is now settled, and in a few days its members will be installed in the Théâtre des Nations, the house which saw the first representation of Gounod's "Faust." As an epilogue to the melancholy tragedy, they are occupied at the Hôtel de Ville about the monument to those who perished, which is to be erected at Père La Chaise, over the burial space given gratuitously by the Municipality. In the same well-known cemetery there is also to be inaugurated a funeral chapel which M. Aldrophe, the architect, has been commissioned to construct over the tomb of M. Thiers, the former President of the Republic.

This monument, on which M. Chapu and M. Mercié have worked, rises by the side of the cemetery chapel, at the summit of the hill situated opposite the principal entrance of the necropolis. It is of rectangular form, built in Renaissance style; the façade 9 mètres in length, and the height 14 mètres. In the centre of the principal façade is an arcade, closed by a bronze gate, opening between two Corinthian columns on granite pedestals, and which carry a complete entablature and attic. In the centre of the attic a tablet of green marble bears the following inscription in gold letters: PATRIAM DILEXIT: VERITATEM COLUIT. In the interior four large arches sustain a domical cupola, with a central window, which gives a dim light at once to the chapel and the crypt under it, which is surrounded by a stone balustrade. Access is given to the crypt by a staircase of thirty steps. The cupola is decorated with figures symbolical of Science, Literature, Eloquence, and History, sculptured by M. Mercié on the surfaces of the four pendentives. At the back of the chapel is placed a fine group by the same sculptor, representing "Thiers répondant à l'appel d'immortalité." This short account will in itself give some idea of the importance of this funeral monument, which, from an artistic point of view, is undoubtedly the most remarkable thing in Père La Chaise.

Besides the new Hôtel du Mont de Piété, at the angle of the Rue de Rennes and the Rue du Regard, and which is to be opened in January next, there are several important buildings in prospect. There is, first, a new hospital to be erected in the 19th Arrondissement, and the construction of a new Mairie in the 18th Arrondissement, in place of the wretched little house hitherto devoted to the municipal service of one of the largest districts of Paris. This latter will undoubtedly be the subject of a public competition.

The Municipal Council for its part has decided, as we have already mentioned, on the erection of a School of Typography, to be called the "École du Livre," which is to be built in the 13th Arrondissement, on ground situated at the angle of the Boulevard d'Italie and the Rue de Gentilly. M. C. Lucas, whose name is well known to our readers, has been commissioned to prepare plans for this great establishment, the construction of which will offer, on account of the slope of the ground, considerable difficulties. When the plans are completed and approved by the Prefect of the Seine, they will be submitted to the Municipal Council, which has already created many professional schools in Paris, such as the "École d'Ebénisterie," the "École de Serrurerie" and "de Mécanique," the excellent results of which can now be appreciated. It is also announced that the State proposes to create a Museum of Oriental Art in which all the Oriental work now in the Louvre will be collected, along with that in the Palaces of Compiègne and Fontainebleau. This new museum is, however, still only an ideal project, and considering the limited resources of the Ministry of Public Instruction, it is not easy to predict whether or when it can be realised.

It may be of some interest to English readers to give the programme of the course of Instruction in Architecture which has been laid down for M. de Baudot, for his new chair at the Trocadéro, the proper locality for which would be the École des Beaux-Arts.

The course, which fills what has hitherto been a serious gap in the official instruction programme, will include three parts:—

1st part. Exposition of methods of construction, employment of materials, building apparatus (*appareil*), construction and planning of buildings, vaulting, carpentry, removal of rain-water, design of buildings in reference to their purposes; their artistic expression, their decoration, their proportions; drawing and design of mouldings; sculpture in its relation to architecture.

2nd part. Restoration of buildings. Explanations of the restorations undertaken under the auspices of the Commission du Monuments Historiques since its foundation; works required in underpinning; shoring; modes and

systems of scaffolding; general conduct of building oporations.

3rd part. Study of the relations between the Middle Ages and the Renaissance; comparison of buildings of these two periods with each other and with the monuments of earlier epochs.

This course has received the complete approbation of the Commission des Monuments Historiques. It will be supplemented by photographs and drawings, and visits to buildings in progress. M. de Baudot proposes also, by way of giving a practical turn to this new experiment, to organise competitions, the winners of which will have the opportunity of doing work for the Commission and on diocesan buildings.

The "envois" of the students at the Villa Medicis, according to the new regulation of the Académie des Beaux-Arts, will be exhibited for eight days during the latter half of the month of October. In the section of architecture M. Esquie, a four years' pupil, has sent a restoration of the villa of Hadrian at Tivoli; M. Redon (third year), a drawing of the actual state, and a restoration of, the Temple of Concorde; M. d'Espouy (second year), a considerable number of water colours, among which are some interesting studies of interior decoration, as well as some details of the Campo Santo at Pisa; and M. André (first year) has sent drawings of the Tomb of Cecilia Metella and of fragments found in the Forum of Trojan. In the commencement of October will be exhibited the forty-five designs sent in for the Troyon Competition. The premium is 1,200 francs, and the successful work becomes the property of the State. The Académie des Beaux Arts has awarded the Jean Leclaire prize of 1,000 francs to MM. Conin and Marcel Berger, pupils of M. Gaudet.

Among other artistic news we may mention the intended transformation of the Arènes de Lutèce into a public square; the discovery at Beaumont-sur-Oise, near Paris, of a Gallo-Roman cemetery; the opening of an Exhibition of Ancient and Modern Engravings in the Galerie Georges Petit, to remain open till the end of November; and lastly, the Commission for two Busts in Marble for the Opera House, that of Félicien David by M. Steiner, and that of Taglioni by Mdme. Laure Coutan.

The death is announced of an architect of talent who was little known to the younger generation of the present day, but who had a legitimate reputation at the commencement of the reign of Louis Philippe,—Daniel Ramée, who has died at the age of 81. He was much occupied for the Monuments Historiques, and to him we owe the restoration of the Palais de Justice of Beauvais, as well as of many curious churches, such as that of Saint Vulfran at Abbeville, Notre Dame de Noyon, the Church of St. Riguier, that of Senlis, &c. He was also a very learned writer, who has left numerous works, among which we may mention a general history of architecture, a dictionary of terms used in architecture (in four languages), a history of "Monumens, Anciens et Modernes," a monograph of the Cathedral of Notre Dame de Noyon, &c., &c. He was, in every acceptation of the word, a good man and a conscientious artist and lover of his art.

P.S.—The departure of the Ministre des Travaux Publics for England is announced, accompanied by the Directeur des Chemins-de-Fer. They are to visit successively Liverpool, Glasgow, and Edinburgh, and the London Docks and the Metropolitan Railway. The moving cause of the expedition is understood to be the question of the Paris Metropolitan Railway, which must come before the Legislature again during the ensuing Session.

Heavy Lightning—Lord Grimthorpe, *à propos* of lightning conductors, with his customary courtesy, writes to the *Times* of his opponent's (also a correspondent to the leading journal) desire to "display his own smartness," and speaks of that opponent's opinions as "mere nonsense, due to his ignorance." He concludes, "If he wants the last word, he is welcome to it." Lord Grimthorpe's last word (if really the last) is preferable.—*Punch*.

Removal.—Mr. Henry Bassant, parquet floor manufacturer, has removed from 18, Wells-mews, Oxford-street, to new and more commodious premises, 89, Charlotte-street, Fitzroy-square, W.

FURTHER NOTES ON THE SANITARY EXHIBITION AT BOLTON.*

We conclude our notes of the exhibition now being held at Bolton under the auspices of the Sanitary Institute of Great Britain.

Messrs. Casebourne & Co., of the Cement Works, West Hartlepool, exhibit (Stall 6) specimens of cement and concrete in their various applications, and one of Faija's patent cement-testing machines. The next Stall (7) is that of the Bolton Paint Company, Limited, who have on exhibition some pigments of good colour, together with dryers, varnishes, brushes, and painters' tools generally. The Asbestos Fire-proof Paint Company (Stall 8) exhibit the applications of their material; and some floral panels, stated to be executed with it, seem to show that it is capable of being used in any colour, so that in skilful and artistic hands the best results may be obtained. The Buttermere Green Slate Company, of Keswick (Stall 9), show a piece of roof covered with their slates, which are admirable in texture and colour. At the next Stall (No. 10) the Bull Hill Fire Clay Company, Darwen, exhibit some very good white and coloured enamelled bricks.

Hardie's furnace for burning town refuse is shown in model and by drawings on Stall 13. To describe it in detail would take up more space than we can here devote to it, but the inventor claims that by its use the materials to be burnt are dried in a close chamber, the noxious vapours and gases generated being drawn through the furnace and there consumed, thus avoiding all nuisance. Mr. Hardie's invention is well worth examination at the present time, when increasing difficulties are felt in the disposal of the refuse of large towns in a manner at once economical and inoffensive. We do not pledge ourselves, without further examination, and without learning the results of practical trials, that Mr. Hardie has solved the problem, but he has, at any rate, contributed some suggestions towards its solution.

At Stall 14 is exhibited a model of a double ash-closet, submitted by the Scavenging and Sewage Committee of the Borough of Bolton as a suitable apparatus for use in Lancashire towns where there is no water-carriage system of sewerage, or where water-carriage is only in partial operation. The model represents what appears to be a very simple and effective apparatus. At the next stand, Messrs. James Duckett & Son, of Burnley, exhibit what they call their patent "self-acting water-closet," which is entirely flushed with waste-water. It is only applicable to situations on the ground floor or in the basement, and when it is located on the ground-floor, the "pan," which is oval on plan and vertical in section, is two or three times as deep as the ordinary hopper, in order, while keeping the normal height of seat above the ground-level, to get the trap at a sufficient depth to be flushed by the waste water from slop-sink and yard. No arrangements are made for flushing the sides of the deep vertical oval "pan" which we have described, but it could probably be cleaned by other means when necessary. In the arrangement which would be most often found practicable, the inventor leads the sink-pipe through the house-wall and discharges it over a grid which covers the tilting-box or chamber, which is in stoneware. Inside this tilting-box is the tilting-tank, a scoop-shaped vessel, also of stoneware, nicely poised on brass or gun-metal trunnions so as to tilt and discharge its contents when full, and to immediately return to its position for re-filling. The liquid discharged by the tilting-vessel passes along a trapped stoneware drain-pipe laid at a fall beneath the yard, and so enters the trap at the bottom of the closet "pan" before described, and flushes it. The surface-water from the yard, as well as the rain-water from the roofs, is made to pass through the grid and tilting-tank, and so all available waste-water is made use of for flushing the closet: but there seems to be no provision for catching grease and solid matters coming from the sink, the presence of which might create in time a stoppage in the trap under the w.c. A useful little detail connected with this appliance consists in the brass bolts and nuts which, while effectually preventing the removal of the grid by children, readily permit of its removal when it is necessary to examine the tilting chamber or tank. Other closets of this type, though differing in details, are shown by other exhibitors, but it is hardly necessary to describe them.

Various forms of dry closet are shown, including the British Sanitary Company's earth closet, Morrell's cinder-sifting closet apparatus and cinder-sifting dustbin, Nicholl's antiseptic sanitary closets, and Moule's earth-closets, all of which have been frequently described and are well known to our readers.

At Stall 20 the International Water and Sewage Purification Company (Limited) exhibit a section of their magnetic spongy-carbon filter as used at the Acton Sewage Works, recently referred to at some length in our columns.

Close by (Stall 80), Mr. J. W. Lovibond, of Salisbury, exhibits a very ingenious instrument which he calls the "Tintometer," which is used not only to determine the colour of water, but is capable of use in a variety of industries,—brewing, dyeing, and bleaching among others. The water of the Croal shows very badly under the test of this instrument. Those of the Irwell and Thames are not shown.

In the annexe to the Drill Hall there are only one or two exhibits of any interest to our readers. The most notable of these are the "Control Air-propeller," shown by the Control Air Propeller Company, and a very well devised inlet for warm and moist air,—a necessary condition for work in cotton-mills.

While speaking of ventilators we may mention that the Æolus Water Spray Company have, as usual, a very good display of their varied and efficient appliances for warming and ventilating.

Messrs. C. Kite & Co., of Chalton-street, exhibit their admirable under-roof ventilators and their excellent silent automatic counterpoise ventilator, of the merits of which we have spoken on previous occasions. The latter apparatus is noiseless in action and extremely sensitive, and is now being adopted for the inlets to drain-ventilating pipes, in order effectually to prevent unpleasant consequences (where such inlets are near to windows) in the event of a reversal of the direction of the current of air in the pipe.

Messrs. J. Wright & Co., of Westminster-chambers, exhibit their now almost indispensable fireproof fixing-blocks, of which the latest application is their use as floor joists,—the "fixing-blocks" when so applied taking the form of continuous lengths of the material of which they are made embedded in or keyed into the concrete, the floor-boards being nailed direct to the continuous fixing-blocks thus provided. A specimen piece of floor so constructed is shown by the exhibitors.

Mr. C. H. Sidebotham (Stall 22) exhibits some useful sanitary fittings, but the pedestal closet in stoneware, to be flushed by waste water by a tipping arrangement, does not appear to be by any means perfect. A novelty, shown by this exhibitor, is Wright & Sutcliffe's "Hair-dressers' Complete Hot-Water Apparatus," which contains in the centre a hot-water boiler, with receptacles for hot-water and soap and brush-holders for three customers at a time. The hot-water receptacles are fitted with wastes, and altogether the apparatus is exceedingly compact and convenient.

Mr. R. Cuerden and Messrs. James Vause & Son are large exhibitors, but the articles and appliances they exhibit are, for the most part, those of other makers, and are very well known.

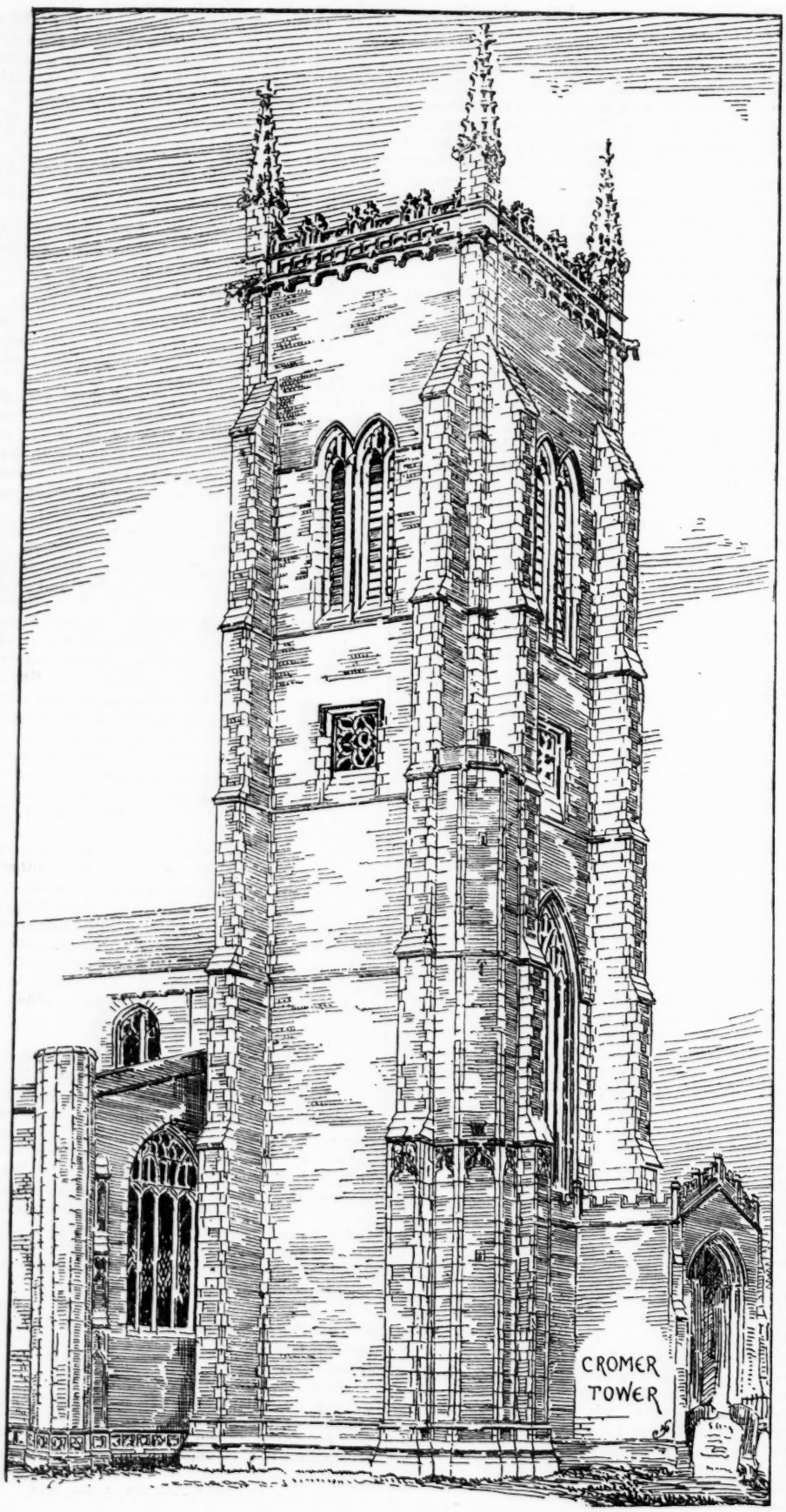
We have now touched upon most of the principal typical exhibits in the departments in which our readers are most fully interested. But Class IV., "Personal Hygiene, Foods, and Disinfectants," is an exceptionally large and interesting one.

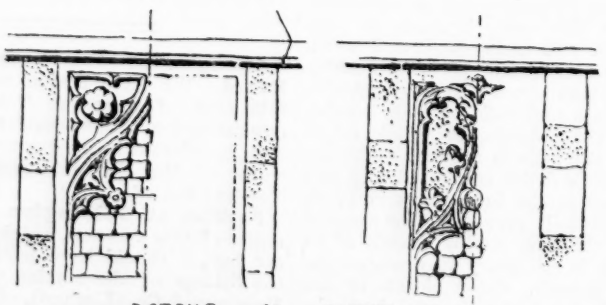
We gave a list of the awards in our last. The exhibition will, as then stated, remain open until the evening of Saturday, October 15.

* See *Builder*, p. 422, *ante*.

Changes at the Local Government Board.—We have reason to believe that, in fulfilment of a recent Treasury minute of reorganisation, some considerable changes will soon be effected in the engineering and medical staffs of the Local Government Board.—*Sanitary Record*.

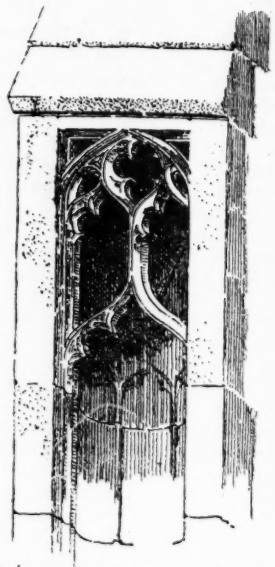
Stables at Folkington Manor.—In our notice of this mansion, which we illustrated in our last, it should have have been stated that the fittings of the stables were supplied by Musgrave & Co. (Limited), of New Bond-street and Belfast. They embody all the latest improvements in such fittings.





CROMER TOWER.

As a pendant to "Notes of a Holiday on the Norfolk Coast" last week, we give a sketch of the tower of Cromer Church, which has some characteristics of its own. The tracery and ornament below the buttress weatherings on the stair turret, of which a detail is given, is



curiously treated, the stone cusping being almost imbedded in the flint-work, which is worked nearly flush with it. The nave buttresses present a pretty feature in the shape of the free tracery over the niches in the upper stage, of which also a sketch is subjoined.

VILLAGE WATER SUPPLY.*

THE excessive drought of the present summer is causing many who have hitherto either never considered the subject of this paper, or who have obstructed the progress of a water scheme, to look upon it as a necessity, and one which must now be dealt with.

Having been brought more or less intimately in contact with many of the difficulties which arise in connexion with the supply of water in rural districts, I venture to think that this paper may not be without interest, and I propose to show that the cost, which is the real deterrent in connexion with the adoption of a water scheme, is in most cases (if a qualified engineer is consulted) far less than is generally believed, and that in many instances where a gravitation scheme not involving the cost of a large reservoir or great length of mains is adopted, it is found that a small water rate, not exeeeding 2d. or 3d. per week per house, is more than sufficient to pay for the whole cost, if the works have been constructed by means of a loan repayable in equal annual instalments of principal and interest.

I propose to give examples of various methods of supply:—1. Gravitation; 2. Pumping; 3. Arrangement with water company or adjacent authority possessing water; 4. Draw-wells and hand-pumps.

Gravitation.—The village of Tansley, near Matlock, is an instance of this method of supply. The population is 678; rateable value, 2,069*l*. Prior to the completion of these works in 1885, the village was entirely without any proper means of water supply, and was dependent on certain surface-fed springs, which failed in dry weather and were subject to pollution; there are also certain small streams flowing through the village, but these are polluted. Messrs. Fowler & Sons, of Sheffield, designed the following scheme, which was successfully carried out by Messrs. Thompson, contractors, of Sheffield:—Two underground reservoirs, of a total capacity of 4,200 gallons, receive water from two springs having an average flow of 36,000 gallons in twenty-four hours. Stoneware pipes bring the water to the reservoirs, which are kept constantly full, the overflow passing into the original channel of the brook. The pipes are cast-iron, 3 in. diameter, and were

* From a paper by Mr. Stephen Harding Terry, Assoc.-Mem. Inst. C.E., Mem. Inst. Mechanical Engineers, Inspector of the Local Government Board. Read at the Congress of the Sanitary Institute at Bolton.

tested to 600 lb. per inch; the greatest head is 180 ft. Eighteen stand-pipes with screw-down cocks and three fire hydrants are provided. Some houses have the water laid on free of charge, except for the cost of connecting the service-pipes. The work is done by the Authority, and repaid by the house-owner. The actual cost of the works, giving a constant supply (up to fifty gallons per head, if necessary) to 678 people, has been 700*l.*, the annual instalment of which, principal and interest, at 3½ per cent. for thirty years, is 38*l.* 1s. 3d., or 4s. 4d. in the pound on the whole rateable value, or about 1s. 2d. per head per annum; or, assuming that there are 114 houses, a water-rate of 6s. 8d. per annum, or just over 1¼d. per house per week, would entirely relieve the general rates of all charge. The capital cost of the works per head of population has been 1*l.* 0s. 7½d., a sum which compares favourably with the cost of supply of most large towns.

Below is given a typical estimate of cost of works of supply by gravitation for two villages situated in Gloucester and Wiltshire. It will be noted that 120 houses, with a population of 560, are supplied at a capital expenditure of 1,200*l.*, and that the total cost, at 4 per cent., repayable in thirty years, amounts to 69*l.* 8s. per annum. The revenue at an average of 3d. per week per house, including farm-houses, is 78*l.*, showing a balance of 8*l.* to meet expenses of collection. There are 5¾ miles of main and service pipes; and as the spring is to be depended on both in summer and winter, a large storage reservoir is not required:—

3 miles cast-iron main, 3 in. diameter, at 2s. per yard laid	£528	0	0
1 mile of 2 in.	165	0	0
¾ „ 1 in.	63	15	0
1 „ ¾ in.	65	0	0
	£821	15	0
Draw-off cocks, stand-posts, air-valves, &c.	78	5	0
	£900	0	0
Reservoir, valves, &c.	100	0	0
	£1,000	0	0
Engineer's commission and contingencies 15 per cent.	150	0	0
	£1,150	0	0

Or, in round figures, say 1,200*l.* for the supply of those parts of both villages which are now without drinkable water. The annual repayment on 1,200*l.* at 4 per cent. for thirty years is 69*l.* 8s.; an equal rate on the whole rateable value 18,303*l.*, would require to be 0·9d. in the pound supposing no special water-rate was levied. Assuming that 120 houses in the two villages are supplied at an average rate, including farm-houses, of 3d. per week, a gross revenue of 78*l.* per annum will be obtained; which will be more than sufficient to pay the entire cost of the loan, and will leave a margin of 8*l.* to meet the expenses of collection.

Pumping.—At present very few villages are supplied from waterworks of their own by pumps worked by steam power, but this system of supply is in many cases the only one possible, and with the production of economical and simple motors, such as those of Davey, of Leeds, is likely to greatly extend. A village in one of the Midland counties is now constructing waterworks of this character, under the advice of Mr. Herbert Walker, of Nottingham. The population is about 1,000, and the works will cost about 1,200*l.* The reservoir will hold about four days' or more supply, and the pumps will raise in one day enough for four days, so that it will only be necessary to run the engine and pumps twice weekly. In this way the charge for superintendence will be lessened. The capital cost per head of population will be 1*l.* 4s.

The annual instalment of principal and interest at 3½ per cent. for thirty years will be	£65	0	0
Assuming coals and supervision to cost*	35	0	0
	£100	0	0

Assuming that 180 cottages at 3d. per week take the water, there will be a revenue of 112*l.* 10s., leaving a balance of 12*l.* 10s. towards repairs and contingencies.

It is remarkable that in this country windmills are so little used for public water supply in villages. They are largely used in America for supplying water on railways for locomotives and station purposes, and if the reservoir filled by them is large enough to contain a week's supply they give very satisfactory results. Small sizes have been in use some years in this country for supplying private houses and farms, and I have recently seen, near Rickmansworth, a large Halliday windmill, with fan 25 ft. in diameter, mounted on a platform 80 ft. high, which raises water from a deep well against a total head of 180 ft. It supplies a mansion, farm buildings, and stabling, together with a large horticultural establishment, and I understand it gives complete satisfaction, keeping the reservoir always sufficiently full. I have no means of knowing the volume pumped, as the speed varies continually, and no water meter is attached.

The little town of Lechlade, in Gloucestershire, which for the purposes of this paper may be considered as a village, has adopted a windmill pumping scheme; the works are now under construction. Water is obtained from two Norton tube wells, and the reservoir and engine are of the Halliday type. The reservoir is a circular wooden one, and carries the framing of the mill on its top. The pump is of the Ontario type. The first cost of the wind engine and reservoir is slightly in excess of the cost of a small steam engine, pumps, and reservoir, on account of the necessity of increasing the size of the reservoir when wind is the power employed to insure a supply during calm weather.

As an example of a pumping supply in a comparatively rural district, I will instance the Sutton-in-Ashfield and Hucknall-Huthwaite Works, which were completed recently, Mr. G. Hodson, of Loughborough, being the engineer. The Works supply a population of 11,000 people in the two towns and adjoining villages; the towns are some miles apart, have separate reservoirs and rising mains, but the same pumping-station. The machinery and buildings are of a very substantial character, and the entire cost of the works has been 17,300*l.*, or 1*l.* 11s. 5d. per head of population. The well yields 1,000,000 gallons daily, but at present only some 300,000 gallons per day are required.

Arrangement with Water Company or adjacent Authority possessing Water.—As an instance of this I may mention Seend, Wilts. The whole of the lower part of the village,—in which there are very few wells, and those polluted,—is now supplied by agreement with the Trowbridge Water Company, who charge 1s. per 1,000 gallons by meter; the Rural Sanitary Authority laying mains up to the limits of supply of the Trowbridge Company, the latter meeting them. The Rural Sanitary Authority charge water-rates for stand-pipes, and the sum thus recovered is almost sufficient to repay principal and interest on the small capital, some 250*l.*, together with cost of water.

Another instance of this is Stanks, near Cross Gates, Leeds. The Rural Sanitary Authority of Barwick, in Elmet, are now completing works for the supply of this hamlet of fifty-one houses. The cost is estimated at 250*l.*, or nearly 5*l.* per house supplied; the revenue derived from water rates at 3d. per house will be more than sufficient to repay the loan in thirty years.

Hucknall-Huthwaite and Sutton-in-Ashfield, the example quoted under the second heading, is an instance of arrangement with adjacent Authority. The Sutton pumping station was first completed, and, the water having been found abundant, it was decided to supply Hucknall from the same source. There are throughout the country numerous instances in which an arrangement of this kind would be made to advantage, but frequently the opportunity is lost through local antagonistic feeling between the parties concerned.

Draw-wells and Hand-pumps. — Several villages in Suffolk and Essex have within the last few years been supplied with water by means of public wells constructed under the Public Health Act and Public Health (Water) Act, and the cost has been defrayed by means of loans; and, as the cost of any well so constructed seldom exceeds 100*l.*, and loans for a period of thirty years are sanctioned, the incidence in the rates is very small. Notwithstanding this these applications are generally met with great opposition on the part of some ratepayers living beyond the reach of the well so constructed.

In public wells, wherever possible, the well should be covered in, and the supply obtained by a pump. Where the depth of water precludes the use of a suction pump, and a deep-well pump, on account of expense, is deemed unadvisable, some form of well engine should be provided, with two buckets, by which the empty bucket descending partially balances the full one ascending; and in all cases of public wells a draw-bucket should be provided attached to the chain, so that the private buckets of those fetching water need never be dipped into the public well. It might be supposed that this precaution is sufficiently obvious, but it is frequently neglected. Children, or even their elders, stand buckets down in filth, and even use buckets which have recently contained filth, and then send them down a public well. To prevent this, all that is necessary is to provide a public bucket attached to the chain, and to protect the mouth of the well, so that no water or filth near the top can pass down through the cover or sides. All wells should be lined with brick in cement for a considerable distance down; in fact, until some impervious strata is reached, to prevent the entrance of impure surface water.

The village of Littlebury, near Saffron Walden, has signalised the jubilee year by making a boring 120 ft. in depth, 116 ft. of which were in chalk. The boring is lined to within a few feet of the bottom with 4-in. screwed flush-jointed wrought-iron pipes. Water rises to within 10 ft. of the surface, and is of excellent quality. Fifty gallons per minute for eight hours consecutively pumped from it only lowered the water level a few inches, and it is intended to connect the vertical pipes with horizontal mains at a depth of about 13 ft., and from this source to supply the lower part of the village, the higher part being already supplied from the pump. The cost of the boring and pump has been 135*l.*; the work was done by Mr. Ingold, of Bishop Stortford. An unsuccessful boring was first made about 100 yards away from the present one to a depth of 220 ft.

Many villages and towns also would have been satisfactorily supplied for less money than the present unsatisfactory schemes have cost, if they had employed engineers instead of those who have had nothing to do with water supply. Schemes are brought out by land surveyors, architects, masons, and others, who, however able they may be in their own professions and callings, have not had any experience in water supply. Some few years ago a proposal was put before me by which it was intended to pump the whole low-level supply of a district 20 ft. higher than was necessary to supply the low level, in order to work a hydraulic ram to raise one-third of the volume an extra height of 80 ft. to supply the high-level district.

It may be objected, by those who unfortunately oppose the progress of sanitation, that I have not dealt with the question of acquisition of water right or compensation; this question when raised is generally too large to be dealt with satisfactorily in a short paper, but it is not too much to say that only a very short-sighted policy would offer obstructive opposition to the adequate supply of a village with one of the first necessaries of life, and in many cases the volume required is so small as to be of no use to the mill interests, although unfortunately a great point is often made of this where a local Authority is treating for a supply.

There are numerous instances in which the mill interests have been greatly benefited by the construction of large storage reservoirs for public supply, as their construction has enabled a given volume of compensation water to be daily delivered to the watercourse during continued periods of drought, whereas without such reservoirs their water would have reached the sea weeks or even months previously in useless floods.

In conclusion, it is hoped that the figures and instances here given will show that the cost of supplying villages with water is not so great as is generally supposed, and that in many cases, where circumstances are favourable, the whole cost can fall on those who are benefited by it.

Section 64 of the Public Health Act empowers a local authority to compel an owner of a house to supply that house with water at such rates as may be in force in the district (if there is a local Act in force), or should there be no local Act, at a rate not exceeding 2d. per week, or such rate as the Local Government Board may consider reasonable. Section 9 of the Public Health (Water) Act, 1878, provides for the levying of water-rates on all houses using water from stand-pipes, if such houses are within 200 ft. of such stand-pipes.

* Arrangements are being entered into with a farmer in the parish for the use of one of his men as engine-driver twice weekly.

The above clauses provide ample means for recovery of the cost of construction of such works as bring the supply into the houses or to stand-posts, whether such supply is obtained by a Rural Sanitary Authority direct or by agreement with a neighbouring Authority or water company. Nothing in these sections, however, provides for cases in which the geological formation or altitude of houses to be supplied prevents the supply of water by means of pipes, either to stand-pipes or into houses. Section 3 of the Public Health (Water) Act, 1878 (framed upon the evidence given before Mr. Alexander Browne's Committee), was intended to deal with cases in which the supply can only be obtained by draw-wells or hand-pumps; but this section has, it appears to me, not been used to the extent which might have been expected, on account of the opposition generally found in rural districts, based on the objection on the part of a ratepayer well supplied with water in one part of a parish to pay for the sinking of wells or fixing of pumps for the benefit of others, perhaps several miles distant. It is true that the framers of the Act in question foresaw this difficulty, and apparently intended that Sub-section 5 should meet it. Sub-section 5 is as follows:—

"Where the owners of two or more houses have failed to comply with the requirements of the notices served on them under this section, and the Authority might under this Act execute the necessary works for providing a water supply for each house, the Authority may, if it appears to them desirable, and no greater expense would be incurred thereby, execute works for the joint supply of water to those houses, and apportion the expenses as they deem just."

In Section 3 power is given to cause works to be executed (wells to be made) at a cost not exceeding 8*l.* 13s. 4d., or, in certain cases, 13*l.* for each house. If water were in all cases sufficiently near the surface to enable a separate well for each house to be sunk for this sum, there would be no difficulty in recovering it by means of a rate of 2d. or 3d. per week on the property benefited. But it is precisely in such districts that a sufficiency of wells (though not necessarily pure) already exists.

It is for cases in which the wells have to be 50 ft., 100 ft., or more in depth, that the power of charging the cost on the property benefited rather than on the whole parish is desirable. At first sight nothing would appear easier than to deal with the matter as follows under Sub-section 5.

Suppose there are ten houses sufficiently near together to use one well, and that such well be made and provided with a pump, or windlass with bucket, chain, &c., at a total cost of 130*l.* If each house-owner paid 13*l.*, or 3d. per week (Section 3), a water-supply for these ten houses would be provided at the cost of those benefiting from it, without increase of rates, or those receiving no advantage from it, and dwelling perhaps miles from it. For reasons which I do not propose to discuss, Sub-section 5 is not so read, the result being that works are seldom carried out under this section,—a thing much to be regretted, as I believe that much of the opposition which retards, and in some cases prevents entirely, the adoption of some form of public water supply, would be withdrawn if it were possible to work under this section. I do not venture to suggest any special alteration or modification in the wording of this section, but I have drawn attention to the matter, as I believe it to be one with which the future of village water-supply is closely connected.

A Perpetual Calendar.—We have received from Messrs. Gordon & Gotch, the publishers, a "Perpetual Dial Calendar," consisting of two cards, turning on the centre, one over the other, and so arranged as to give the day of the week for any date from the year 1753 to the year 2005. It is ingenious, though the only practical advantage of such a thing is when it is required to find the day of the week for a date either far back or far in advance of the existing year, which it is some times necessary to do.

University College Architectural Lectures.—"Education, Cultivation, and Examination" is the comprehensive title selected by Professor Roger Smith for the opening lecture of his courses at University College, to be delivered at half-past seven on Wednesday next, the 5th of October. The subject will, of course, be treated mainly as it bears upon the study of architecture. The classes will begin the following week.

ARCHITECTURAL ASSOCIATION VISITS.

The last vacation visit of the Architectural Association was made on Saturday, the 24th inst., to a house in Cadogan-place, built from the designs of Messrs. George and Peto. The exterior is a picturesque treatment of Flemish character, built with red brick and buff terra cotta. The entrance lobby is arranged with a mezzanine boudoir, which is approached by a separate staircase from the hall and opens out into the drawing-room with an arcading, forming a kind of gallery. The drawing-room has a very rich plaster ceiling; the staircase is framed of oak, wrought all over with carving; the dining-room is panelled with oak, the upper panels being covered with carving; the billiard-room, over the dining-room, has an open timber roof of oak with a lantern light, a charmingly sunny effect being given by covering the lantern with silver and bronze lacquer; the boys' room, off the billiard-room, is to be panelled throughout. The whole of the house is arranged with a double system of electric and gas lighting, the electricity being generated under the stable by a dynamo and eight-horse-power gas engine. The stables, which are in the rear of the house, and are fitted for eight horses, can be reached by a passage from the dining-room,—a very ingenious piece of planning. The entire house is full of the most piquant and picturesque features, and is certainly the most interesting and complete specimen of a modern town house that the Association has visited. The interest felt was evidenced by the large number of members who attended the visit.

Illustrations.

DECORATIVE PAINTINGS FOR THE CHURCH OF ST. GREGORY, SUDBURY.

THE designs published in this number are to be painted as wall decorations in this church; they are designed by Mr. Aveling Green, and are to be executed in spirit fresco. The figures are life-size. The following brief notes on the history of the church and neighbourhood, for which we are indebted to Mr. Green, may be of interest:—

The town of Sud- or South Bury was the principal borough of South-east Anglia as far back as A.D. 797, when "The Anglo-Saxon Chronicle" mentions the death of Bishop Alfrin at Sudbury. About the year 970 Atherie founded a hospital, giving a moiety of Northoo to St. Edmund's Bury and the other to St. Gregory's, Sudbury. Not long after this the Lady Ethelfleda, widow of Bethnoth, Duke of East Anglia, bequeathed the land at Weadinga Felder (Waldingfield) to St. Gregory's Church, Suthbyngensis (Sudbury), as her sister had desired on her death-bed. This Count Be(r)thnoth most bravely resisted the Danish invaders, and was killed in battle at Maldon, in Essex, and buried at Ely Abbey. His widow also helped to found the Abbey at Ely, and gave a fine piece of tapestry on which she had worked her husband's exploits. In Domesday Survey St. Gregory's is said to possess fifty acres of land and fifty of meadow. The Manor of Sudbury, with many others was conferred by William I. on Richard de Clare, afterwards Earl of Gloucester and Hereford. Its first charters were granted by this powerful family. In the reign of King John, Amicia, Countess of Clare, gave this church and its property to the Prioress of Eaton, which grant was ratified by Henry II.

Coming down to the later half of the fourteenth century we are probably contemporary with the present building, for it was purchased from the Nuns of Eaton by Simon de Sudbury, afterwards Lord High Chancellor of England and Archbishop of Canterbury, and finally beheaded by the rabble of Wat Tyler's rebellion in 1381.

The present church is mostly in the Early Perpendicular style, and has a very fine tower with a peal of eight bells. It underwent large alterations in pre-Reformation times. The chancel arch is of an earlier date than the piers which support it, and has been spread open to suit its present position. Simon raised the roof of the nave and built the clearstory. The north arcade belongs to A.D. 1350, and the south may be as late as 1530. The fine chancel, with its lofty Perpendicular windows, is 62 ft. long by 21 ft. wide. Its size and length and noble altar may be due to the fact that Simon of Sudbury established close by the church a College of Secular Priests on the ground where his father's house stood, now occupied by the Union House. The twenty oaken "Miserere" stalls still retain their original position. The church contains a remarkably fine font-cover of rich tracery and tabernacle work, over 12 ft. high, richly painted. This church had fallen into very serious decay, and thirty years ago was closed as being dangerous, but it has been gradually restored to something like its pristine glory under the guidance of Mr. Butterfield, freely and generously given. The area of the church is mainly seated with chairs and every seat is free.

"PROPOSED CHURCH OF ST. MICHAEL."

This church was designed to be built of stone throughout, and upon ground sloping, so that the eastern chapel would be on a lower level than the rest of the church. Steps from the chancel aisles would lead to a passage under the higher level of the chancel, and so in to the chapel, which would also have an external door.

The drawing from which it is taken was exhibited at the last Royal Academy Exhibition. The author does not give us any information in regard to the locality of the building, and we therefore publish it as an Academy exhibit, with the title under which it was accepted at the Academy.

ALL SAINTS CHURCH, SOUTHEND-ON-SEA.

The church, of which a view is given in this number, is built of red brick both inside and out. The roofs are covered with Broseley tiles of a purple tint. The accommodation, when complete, will be for 468. The church is seated with chairs. All the roofs inside are boarded on the face of rafters, and ribs planted on the face of boarding, and spaced out into different panels for future decoration. This is done on account of the gun-firing in the neighbourhood, which would bring down the plaster from the roofs. The architect is Mr. James Brooks.

THE MONUMENT TO THE LATE MR. WHICHCORD.

We give this week a view of this monument in Kensal Green Cemetery, referred to in our last issue, which has been designed by Mr. E. R. Robson to the memory of the late Mr. Whichcord, Fellow and Past-President of the Royal Institute of British Architects.

FOUR SOMERSETSHIRE TOWERS.

The four towers shown here are reduced from measured drawings by Mr. J. Gerhard Tiarks. They are good examples of the architectural characteristics of this class of towers.

NORTH PORCH, HARFLEUR.

The town of Harfleur, as every one knows, is situated a few miles from Havre, and was formerly the chief port at the mouth of the Seine, but, owing to the silting up of the channel, it has been left high and dry, and Havre has taken its place. The town was taken in 1415 by Henry V., after a forty days' siege, and the tradition is that Henry vowed to erect a church in memory of his triumph.

The north aisle of the church, with its fine porch, of which we give a sketch, and the tower, were probably erected in pursuance of this resolve. The body of the church has suffered so much from repairs and decay, that its interest has been nearly obliterated. There are some good timbered houses round about, and the whole place is delightfully picturesque.

F. W.

Surveyorship, Tiverton.—On Wednesday, the 21st ult., Mr. John Siddalls, Surveyor and Inspector to the Brownhills Local Board, was elected by the Tiverton Town Council to the office of Borough Surveyor, at a salary of 225*l.* per annum.

Balusters and Newels.—Messrs. Carter & Aynsley send us a volume of designs of balusters and newels kept, we presume, in stock. They do not show anything new or original, but may be useful to select from when it is not deemed necessary to go to the expense of making such things from special designs.

ST. PETER.

ST. JAMES.

ST. JOHN.

ST. PETER.

ST. JAMES.

ST. JOHN.

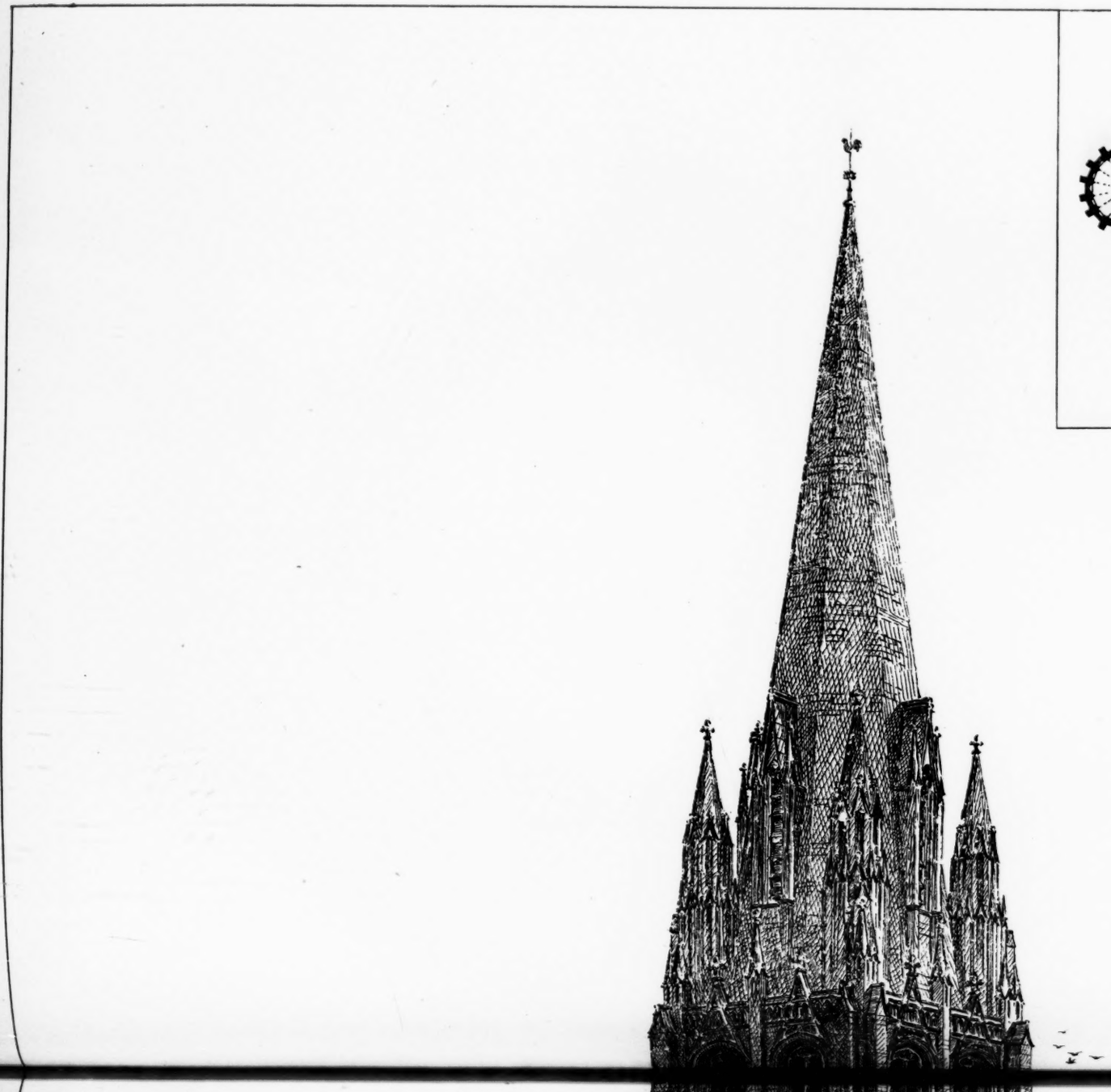
ST. JOHN BAPTIST.

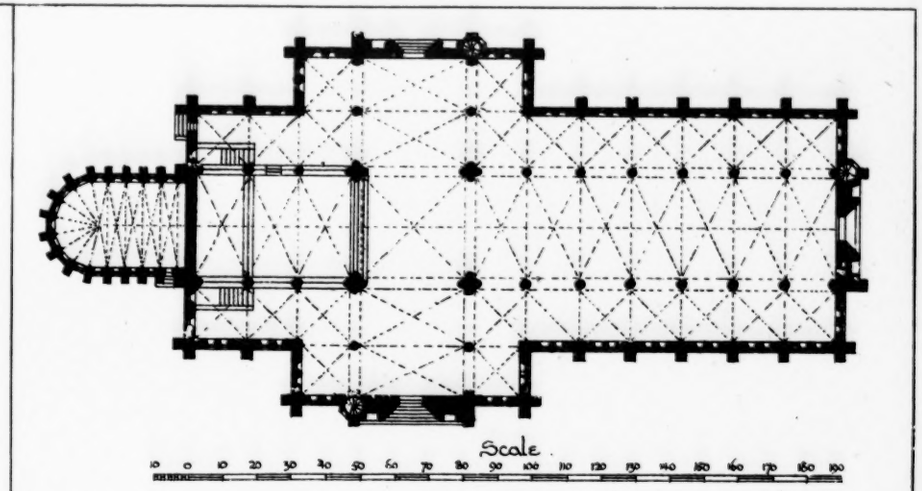
ELIJAH.

MOSES.

INK-PHOTO SPRAGUE & Co 22, MARTINS LANE, CANNON ST, LONDON, E.C.

FRESCOES AT THE CHURCH OF ST. GREGORY, SUDBURY, SUFFOLK.—DESIGNED BY MR. AVELING GREEN.

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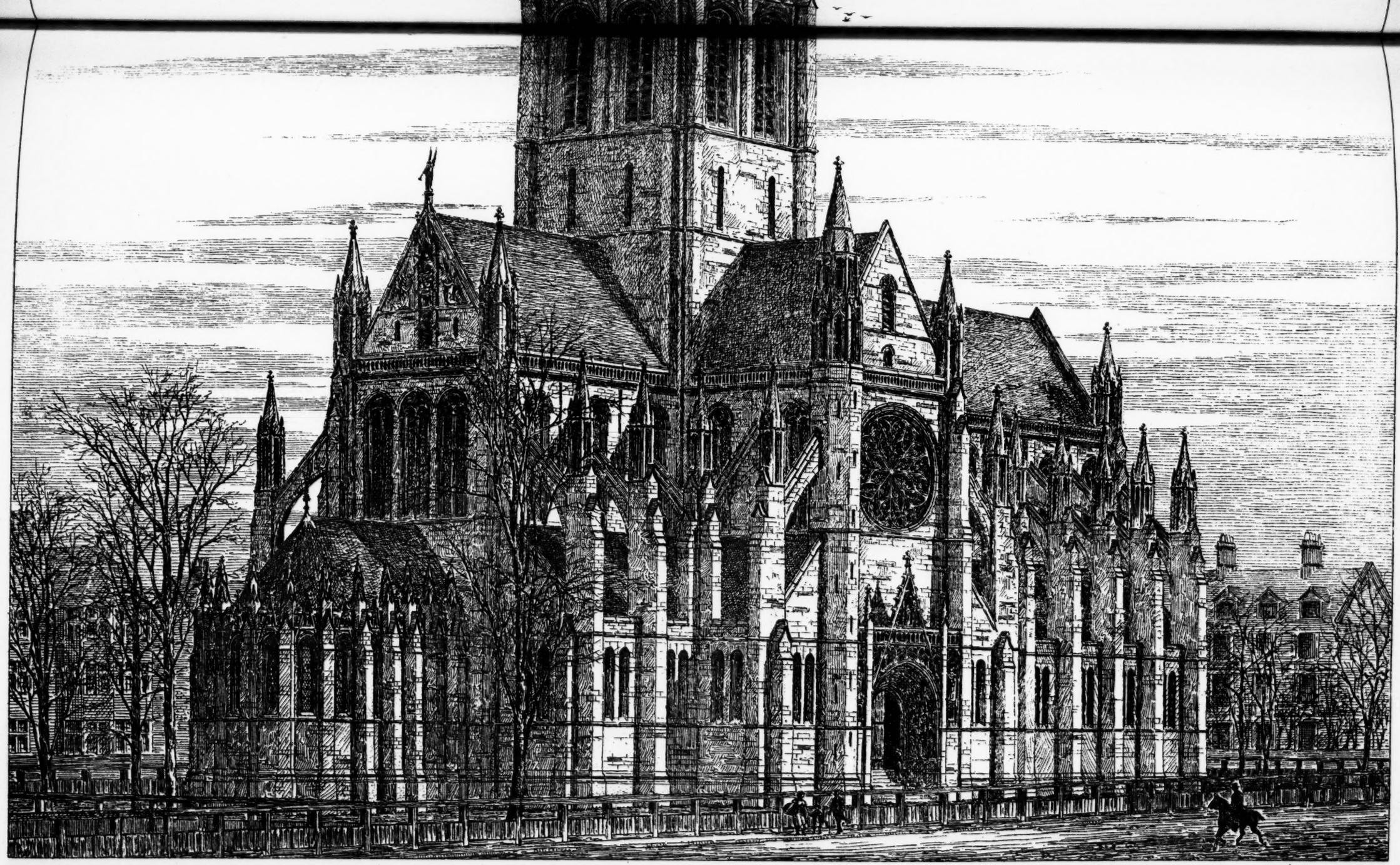
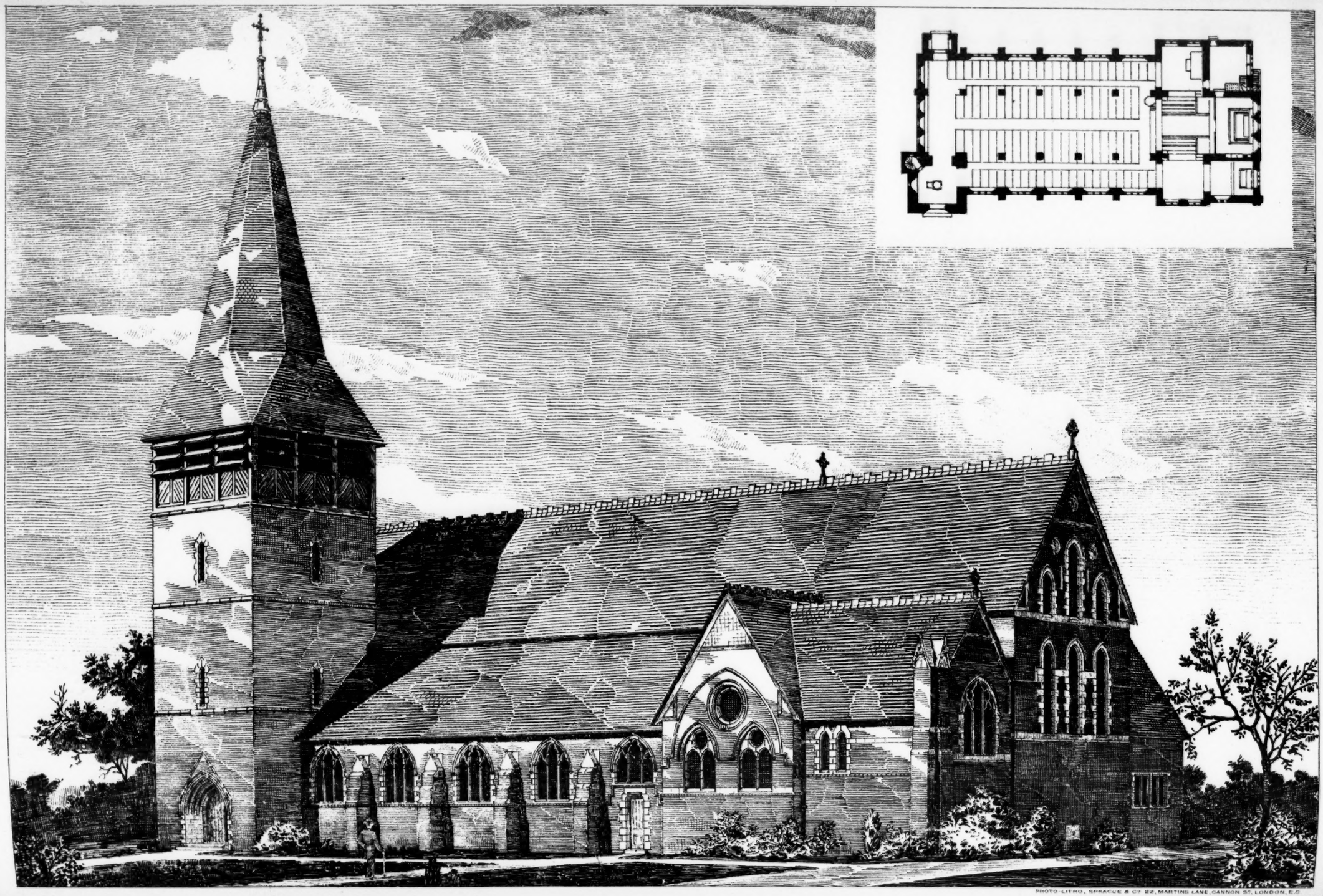


PHOTO-LITHO. SPRAGUE & Co., 22, MARTINS LANE, CANNON ST. LONDON, E.C.

CHURCH OF ST. MICHAEL.—Mr. P. J. Marvin, Architect.



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ALL SAINTS CHURCH, SOUTHEND-ON-SEA.—Mr. James Brooks, F.R.I.B.A., Architect.

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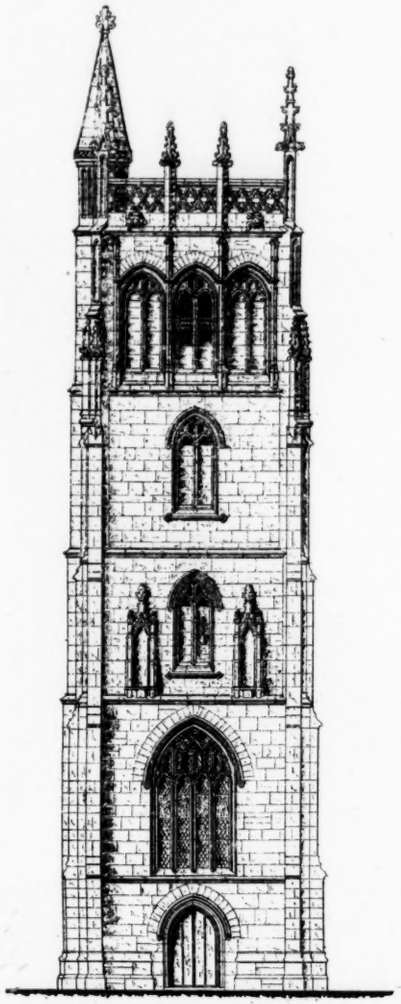
MONUMENT TO THE LATE J. WHICHCORD P.R.I.B.A.—DESIGNED BY MR. E. R. ROBSON, F.R.I.B.A.

Church of St James Winscombe.

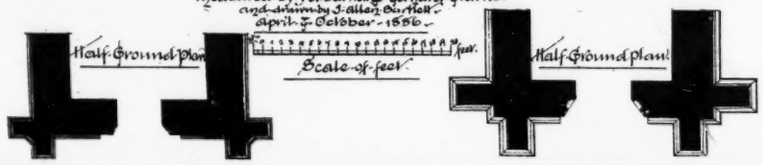


The West Elevation of Tower.

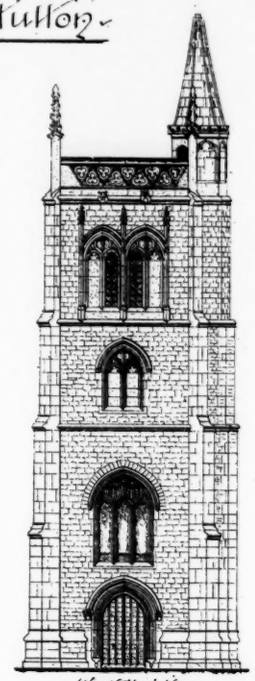
Church of All Saints Wrington.

The West Elevation of Tower.

Measured by J. G. Barker & J. Gerhard Clarke and drawn by J. Allan Gurney April & October 1886.

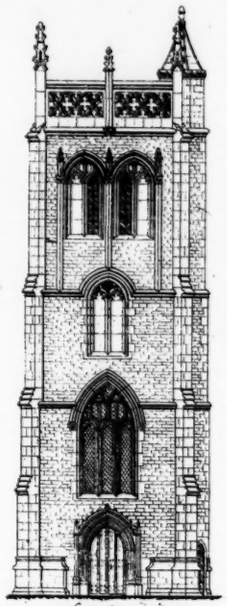


Church of St Mary Hutton.



West Elevation.

Church of St Augustine Locking.



West Elevation.

N.B. - The central pinnacle of Locking is restored on the drawing and the turrets are similar to those now standing on the west face of the tower.

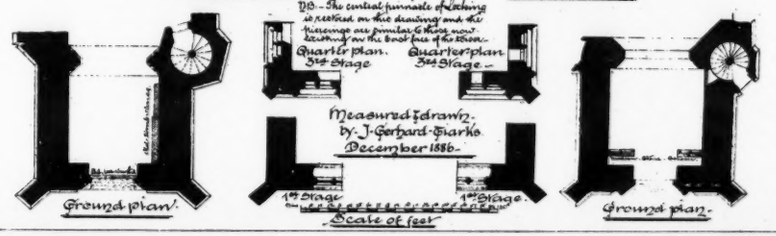
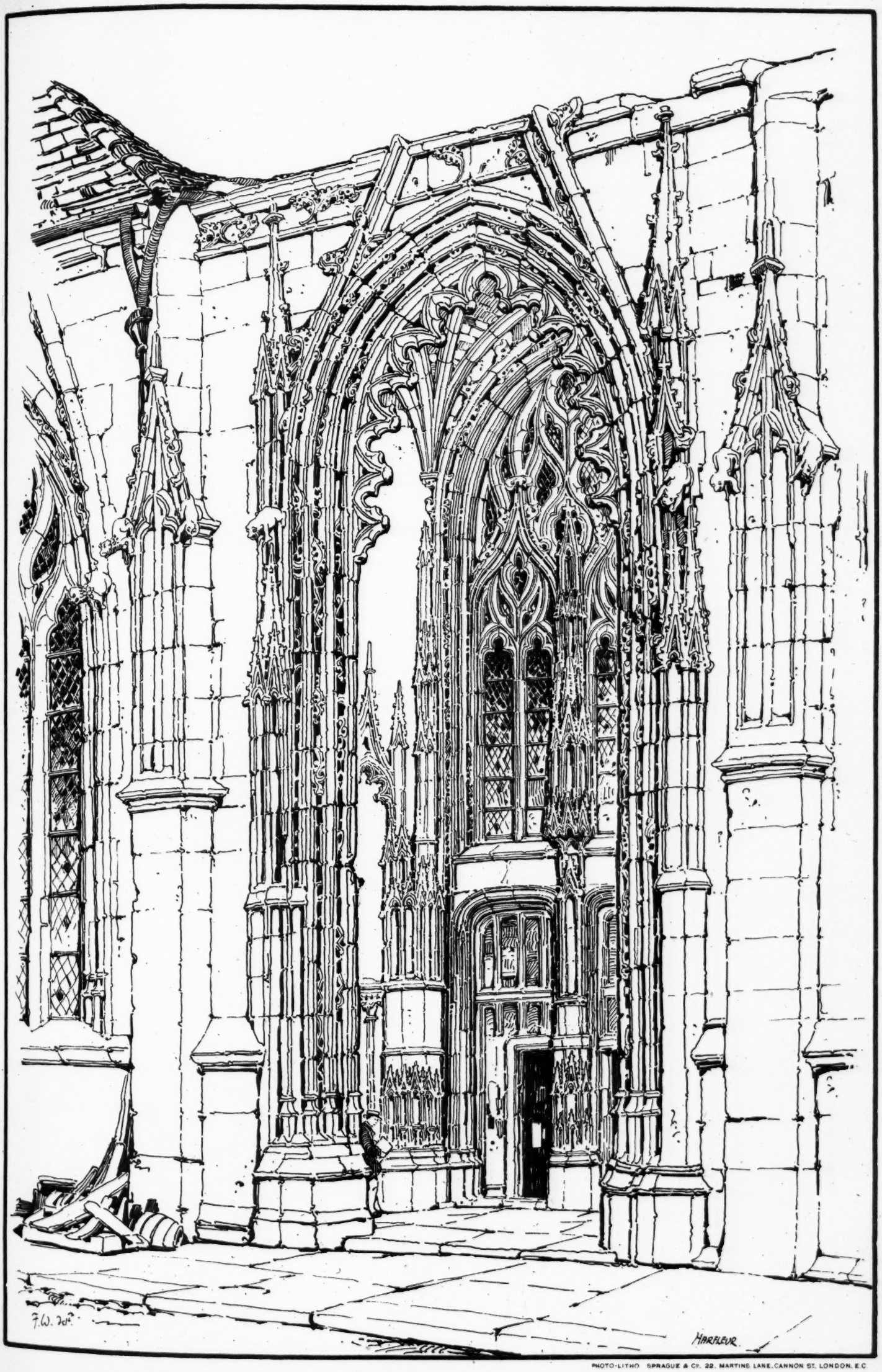


PHOTO-LITHO., SPRAGUE & Co 22, MARTINS LANE, CANNON ST., LONDON, E.C.

FOUR SOMERSETSHIRE TOWERS.



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NORTH PORCH OF CHURCH AT HARFLEUR.

ON THE "SANITARY REGISTRATION OF BUILDINGS BILL, 1887."*

As the Sanitary Registration of Buildings Bill, 1887, has received a good deal of attention in some quarters, while its importance as affecting householders seems to have been lost sight of by those most interested in its provisions, a few remarks on what is proposed to be effected by the Bill may not be inopportune. The object of this Bill is stated to be the compulsory registration of the sanitary condition of all buildings used for certain specified purposes, and the voluntary registration of any other buildings.

A very strong feeling exists, it is thought, that the general sanitary condition of buildings is not what it should be, and as there is at present no means, short of having the building inspected by a professional man at some expense, which enables an intending occupier to know anything of the sanitary condition of the house he proposes to rent; and as, in the case of hotels, asylums, and other buildings of this description, even this protection is not afforded, for it is obviously impossible for every visitor to an hotel, every father who sends his son to school or college, to have the sanitary condition of such buildings examined; it is, therefore, thought that if the owners and occupiers of such buildings could be obliged or encouraged to have their properties inspected, and these inspections registered, such an arrangement would give confidence to the public, and would be of general advantage, both to the users of the buildings and to the owners and occupiers; and it is hoped that when these advantages become apparent, owners of houses not included in the list of those which must be registered compulsorily, would see that it is to their advantage to have their properties registered, and would voluntarily take the same course.

Should it be found possible to draft a Bill which would effect this change in the liability of owners, and oblige them to be able to show the satisfactory sanitary condition of their property at any time, and to do this in a simple and efficacious manner without throwing any undue burden on any person or class of persons, it seems pretty clear that a public benefit would be the result. But whether the Bill lately before Parliament would have the desired effect, or would in itself be a public benefit, may be doubted; and the writer is of opinion that the objections to it, as at present drafted, are many and serious, and it is with them that he now proposes to deal briefly.

The Bill provides that hotels, schools, colleges, hospitals, asylums, and lodging-houses shall be put in a satisfactory sanitary condition and registered; but if it be necessary that these buildings should be certified by a licentiate in sanitary practice, it is equally, if not more, necessary and important that boarding-houses, restaurants, bakeries, butcheries, dairies, and places of whatsoever description where food is collected, stored, or manufactured, and whence it is distributed, should come under the same category. The first-named places are all more or less subject to publicity in cases of illness or epidemic, but how much evil may result from faulty sanitation in the latter, who can say? To trace any illness arising from bad drainage in the buildings named in the Bill is comparatively easy, in those indicated by the writer exceedingly difficult; yet these latter are entirely omitted from the provisions of the Bill.

The Bill is one of registration only; and although the Local Government Board is specified as the authority under which the Bill should be put in force, if it be enacted, no power is given to that body beyond the registration of the acts of the Licentiates in Sanitary Practice, who, so long as they act up to certain very vaguely defined requirements specified in Clause 10, have a free hand and are answerable to nobody, and do not draw their power to act from any authority save that of the Bill itself, and their own ability to obtain a certificate or licence. This seems to be rather an invidious position for a Board entrusted with the supervision of sanitary matters, and as registering machinery only is required, the writer suggests that such machinery already exists in the persons of the Registrar-General and his Registrars of births, deaths, and marriages; and that this machinery might be used with less friction and to more advantage than that indicated in the Bill.

It is left an open question in the Bill as to who shall bear the expense of the alterations rendered necessary by its provisions, and it may be inferred that, as the occupier would be the person who would have to pay the penalty if the work were not done, and as he would be more easily reached than any other person, he would be made to bear this cost. This does not seem to be just, as, if there be an obligation on the part of somebody, as is certainly implied by the existence of this Bill, that buildings should be in a sanitary condition, such obligation must surely rest with the owner of the building in question; it is, therefore, suggested that it should be a provision of this or any similar Bill, that the occupier should have power to recover from the owner in the same or a similar manner as is provided in Clause 97 of the Metropolitan Building Act.

In like manner no provision is made for the localising of the charges which would be incurred in enforcing the provisions of the Act, in printing and forwarding notices, in registering Licentiates and buildings, and in carrying out the necessary examinations; it is, therefore, suggested that fees should be charged for each of these acts, with the exception of printing and sending notices, and that any expense incurred beyond the amount provided by the fees should be supplied by the department of the Registrar-General, and should be under his control.

In the Bill before us, it is provided that (1) Members of the Royal Institute of British Architects, Members of the Institution of Civil Engineers, and Members of the Royal Institute of Architects of Ireland, who are registered in accordance with this Act as qualified in sanitary practice; (2) Architects and Civil Engineers who have been in practice three years at the passing of this Act, and who shall before the 1st day of January, 1890, prove to the satisfaction of the Local Government Board that their practice as architects or civil engineers has been a *bonâ-fide* one, and has included the designing and carrying out of constructive works; (3) Sanitary associations incorporated by licence of the Board of Trade; (4) Medical practitioners registered as qualified in sanitary science; (5) Persons who are medical officers of health at the passing of this Act; (6) Such other persons as the Local Government Board may consider qualified, shall receive licences in sanitary practice, and that these licences shall be given free of cost to those who come under Sections 1, 4, and 5 of this clause.

What is intended by the words, "who are registered in accordance with this Act as qualified in sanitary practice," and "registered as qualified in sanitary science," is not very clear. If it be intended that Clause 9 is to refer to those after whose designation this limitation is placed, it refers to the members of the three leading institutions, who must be examined by examiners, themselves unlicensed and unregistered, appointed by the respective institutions, before they can receive licences to practise; while architects and engineers who do not belong to any institution have merely to satisfy the Local Government Board of the *bona fides* of their practice and experience. Sanitary associations and medical officers of health are under no limitations at all, and any other persons whom the Local Government Board may consider qualified will receive licences to practise. If this be the true reading of Clauses Nos. 7, 8, and 9, it is so manifestly absurd that it does not require further comment, especially as medical practitioners are required to be qualified in sanitary science, not in sanitary practice,—a very different thing,—and no provision is made by examination or otherwise for their registration as having this qualification.

If the interpretation given above be the true one, then the order of precedence stands as follows:—1. Sanitary associations; 2. Medical officers of health; 3. Such persons as the Local Government Board may consider qualified; 4. Architects and engineers not members of one of the institutions named; 5. Members of the institutions; 6. Medical practitioners.

The highest place in the list is taken by sanitary associations, who, as corporations, have no knowledge whatever of sanitary matters; who do not deal with these things themselves, but through their subordinates and officials; who are practically exempt from the penal clauses which are introduced for the punishment of those who contravene the provisions of the Bill; and who are, as corporations, simply collections of business men who, by joining forces, are able to employ qualified experts to do the necessary work; and who, again as corporations, are able to advertise themselves, which the qualified expert, who does the work, is by professional etiquette prevented from doing. The claim of any corporation to receive a licence in sanitary practice is so utterly absurd that the writer does not think it necessary to carry the argument further, and presumes that he has failed to attach their true meaning to these clauses.

If, however, it be intended that all the persons mentioned should receive licences, the position is not much better; there are other professional members of the institutions named fully as well entitled to practise in sanitary science as their brethren who have attained to full membership, and they cannot do this as corporate members of these institutions, but must get their licences under Section 2, as other architects and engineers. Sanitary associations still retain an equal position with professional men; medical practitioners may be qualified in sanitary science, but are not, unless in a few isolated cases, in sanitary practice, and are therefore not qualified to inspect and superintend work, which, perhaps, more than any other requires practical knowledge to ensure its excellence. Medical officers of health labour under the same disabilities as medical practitioners, and are besides hampered by their official position, and the other persons should not exist as other persons; if they wish to practise they can do so as professional men, or not at all.

To follow these arguments to their conclusion, it is considered that only corporate professional members of the institutions named, to which may be added the Institution of Civil Engineers of Ireland, who have reached the age of twenty-seven years, should receive licences on application; that architects and engineers who come under Section 2 should satisfy the examiners in the same manner as it is here provided that they shall satisfy the Local Government Board; that all other persons shall be required to pass an examination before they can receive their licences; and that the words "corporations" and "associations" should be entirely removed from the Bill.

If such vague and meagre minimum requirements as those contained in Clause 10 be considered to be a sufficient protection to the public,—and this can only be the case if it be thought that the understanding on this subject is so thorough and general that there can be no difference of opinion,—why introduce any such clause at all? If, on the other hand, this thorough and general consensus of opinion does not exist, it is absolutely necessary that the specification should be as full and ample as it possibly can be on broad lines; and this can be no hardship to anybody, for if the consensus of opinion be general, the specification will be followed naturally and without effort; if the consensus of opinion be not general, or if there be any sanitarians who are ignorant of modern requirements, it is the more necessary that there should be a complete and binding specification, to which reference can be made and from which no divergence can be permitted.

In Clause 14 it is provided that after the lapse of five years a building shall be considered uncertified; also that any alteration to any building which affects the sanitary arrangements of such building shall render the certificate null and void; but no provision is made for enforcing the publication of such alterations, which might easily be carried out without their coming to the knowledge of the Sanitary Registration Authority, or of any person interested in preserving the satisfactory sanitary condition of any building. It is suggested that the builder or any person who carries out such alterations should be bound to inform the Sanitary Registration Authority of such alterations being made, under penalty as for misdemeanour in case of non-compliance with these requirements. As the enactment of such a Bill as that under consideration would be likely to give rise to much advertising of ability and readiness to certify for the condition of buildings by those who are not prevented by professional etiquette from taking this course to make themselves known, it is proposed that a clause should be introduced rendering it penal,

* On the "Sanitary Registration of Buildings Bill, 1887." From a paper by Mr. Reginald E. Middleton, M.Inst.C.E., M.Inst.M.E., Vice-President of the Civil and Mechanical Engineers' Society. Read at the Congress of the Sanitary Institute of Great Britain at Bolton.

by loss of licence or otherwise, for any licentiate to advertise, or allow to be advertised, his ability and willingness to grant certificates, otherwise than as is provided for in the Bill, that is to say, by the published lists of licentiates; also, as abuses might arise from licentiates who were owners or part-owners or otherwise pecuniarily interested in buildings certifying for their own property, it is thought that provision should be made against this danger, by enacting that no licentiate shall grant a certificate for any house or building of which he is the owner or part-owner or in which he has any pecuniary interest other than as an adviser in its construction.

It is not thought advisable that any penalty should be recoverable before a justice of the peace unless he be sitting in court.

The writer trusts that these few remarks may be sufficient to stimulate discussion, and that thereby valuable information may be obtained which may result in a Bill being drafted and eventually enacted, which shall be satisfactory to all persons interested.

A NEW CEMENT-GRINDING MILL.

One of the most important of building materials in the present day is Portland cement, and its extensive use in the many purposes for which it is employed renders every means of improvement in its quality and in the cost of production a matter of widespread interest to the building trades. In former days the cement was far less carefully burnt than is now the universal practice; and in those days it was sold as it was ground and came from the mills. Now, on the other hand, the practice of sieving has got firm hold amongst the manufacturers, and the tendency to finer and finer sieving increases. The milling thus becomes a serious part of the commercial production, and many firms have made considerable expenditure on trials of new machinery, but hitherto with little practical results. Amongst those who have tried to keep themselves in the van of progress are Messrs. Booth, of Borstal, on the river Medway, which, with the neighbouring Thames, may be looked upon as the birthplace of the Portland cement industry, which has attained to immense dimensions, although the origin itself is within the memory of this generation.

This firm has recently put up one of the composite edge-runner mills of Messrs. Dutrulle & Co., and on Monday, the 19th ult., a large party of cement-makers and factory-managers were present at a crucial trial of the apparatus, which was made by Messrs. Taylor & Neate, at their engineering works at Rochester.

The idea of the new mill is a very simple one: so much so, indeed, that (as is the case with so many good practical inventions) the moment it is seen one wonders that it has never been put into practice before. It may be briefly said to be two pairs of edge-runners working in the same pan. But it is rather more than this, for one couple is composed of two runners of unequal diameters, each running on its own bed, whilst the other pair are runners of equal diameters running on one bed common to both. These beds are in the form of ring steps. The smallest and lightest runner, on the upper and inner circle, takes the broken-up clinker as the feed falls in. From this step the first crushings are swept by a trailing rake, or scraper, on to the second step, where the materials get crushed down again by the second-sized runner. From this, again, the crushed material is raked off in like manner on to the outer ring, where the two largest edge-runners pulverise it to an almost impalpable powder. The elevators take the final ground materials up to circular sieves, with very fine meshes; and the residue, after sifting, is returned to the mill. No doubt a good deal of the success attained is due to the hard and roughly crystalline structure of the steel used for the facings of the runners, and which wears to an almost granitic surface. But it is clear also that this composite mill is doing the work of three ordinary mills at once, without the time, labour, and expense which would be incurred in transferring the loads under treatment for considerable distances from one ordinary mill to another. Or we may say that the stuff must be kept for at least three times the length of period in a common mortar-mill to grind it down to the same degree of fineness. In fact, more than three times the period would be required, because in the common mortar-mill there would always be a thicker load in the pan, the intermingled dust in which would keep the surfaces of the edge-runner and the bed apart, and so diminish the speed and capacity of reduction by the mill-stones. In the new mill the full value of the first two runners is got upon the first and second break-downs; and finally only small materials in a thin layer come under the action of the finishing rollers, which are, in this way, able to crush down very rapidly, through the nearness of their surfaces with that of the mill-bed. The Borstal machine is closely housed in a wooden casing, and the whole occupies a very compact space indeed.

In the trials the speed of feeding was very fast; but not too much so for excellent results to be obtained, as was thoroughly demonstrated by the sievings themselves. It is clear, however, that by a little experience the feed can be absolutely adjusted to the exact degree of milling to which the materials should be subjected; and with such care in the setting of the speed of feed, perfect uniformity would be attained in the cement produced. The feed is made direct into a hopper leading to the mill. Of the mill itself, the bed is permanently fixed, and both couples of runners revolve round a central vertical shaft, which can be driven either at top or at bottom by crown-wheels and pinions. The indicator-diagrams were taken at the trial by Mr. Neate; and the weighing and sifting was supervised by Mr. Hollick, of Greenwich, one of the visitors present, and well experienced in the manufacture of cement. The results of the engine-power were:—Mean speed of the horizontal two-cylinder engine, 67·4 revolutions per minute; average gross power of right cylinder, 35·5 indicated horse power, of left cylinder, 33·3: total, 68·8 indicated horse power. The power exerted by right cylinder in overcoming friction of the engine and shafting was 11·93; of the left cylinder, 10·87; in all, 22·8 indicated horse-power. The net power, therefore, absorbed by the mill in grinding the materials was, as obtained by deducting friction horse-power from gross horse-power, 46 indicated horse-power for the half-hour run.

The results of the weighing and sifting tests, as weighed by Mr. Hollick, were 39·25 cwt.; the temperature of the cement by centigrade thermometer, 37·5 degrees; by Fahrenheit thermometer, 99·5 degrees; the weight per bushel, 117 lb. The residue from the cement on sifting through a 150 by 150 mesh sieve, 40 per cent.; through a 80 by 80 mesh sieve, 24 per cent.; and through a 50 by 50 sieve, 12·5 per cent. The net power absorbed per ton of cement ground per hour will be 11·72 actual horse-power.

There were present amongst the visitors and experts Mr. Johnson, of Northfleet; Mr. Courtney, of Sittingbourne; Mr. Hall, of Rugby; Mr. Weigner, Mr. Formby, Mr. Craske, and many others, as well as the patentee, Mr. Dutrulle, and a favourable opinion was expressed without exception by all the practical men.

THE WALLS OF CHESTER.

Sir,—In reply to Messrs. Roach Smith and Loftus Brock, in your last number [p. 441], I will reply as briefly as possible, considering the amount of ground to be travelled over.

Mr. Smith, whose letters are always worthy of study and consideration, says it is not the question what the Archæological Institute thought in 1886, but what they think now. Just so. I have been in communication with many of the members, and they by all means hold the same opinion they did in 1886. Mr. Smith names the impartial verdict of Sir James Picton and Mr. Loftus Brock. The former of these gentlemen, in his last letter on the subject (*Liverpool Courier*, Sept. 17th), says that he will pronounce "no opinion as to the date or the builders" of the walls, but waits further investigations. As Mr. Brock was the only other speaker at Chester, it follows that his *ipse dixit* was by some, perhaps, tacitly acquiesced in (though very few actual members of the Association were present, the bulk being Liverpool visitors), whilst the anti-Roman party were, as I have said elsewhere, by agreement silent.

As to the Jacobean theory, I have never said a word about it one way or the other; but as to the writers on the non-Roman side, they are, at least, as numerous as those on the other. More will be, however, forthcoming immediately.

Mr. Smith quotes a number of examples in France, &c., of walls built up with the fragments of Roman monuments, but there has been in the cases of many of these towns much discussion, and much doubt as to the age of the walls so built. With regard to the two London instances (Tower-hill and Camomile-street), Mr. J. E. Price, who, on behalf of the Corporation, superintended the excavation of the latter, says in his published report that both may be of the thirteenth century. With the exception of the mortar, they are both similar to Chester.

That the sculpture which Mr. Smith says is a Romano-British girl holding a mirror is not so is the verdict of 99 out of every 100 persons who have seen it. Nearly every one recognises it as a male, most as an ecclesiastic, and many see the remains of a *nimbus* round the head, with a vessel holding the consecrated wafer in the hands. It may, no doubt, be perfectly true that Mr. Smith has engraved in the "Collectanea Antiqua" the figure of a girl holding a mirror found at Bordeaux, but it is not like the stone named.

Mr. Smith refers again to the *castra* at Richborough, &c. He said at first that these *castra* had no mortar in their foundations, and consequently that they resembled the wall newly laid bare at Chester. I pointed out that they were solidly cemented from summit to base, whereas at Chester there was no mortar whatever, *nor had there been*, and I asked him if he ever knew of the wall of a Roman *castrum* (not other buildings or aqueducts, &c.) in which there was no mortar used from base to summit? He has not yet answered the question, but says that at Richborough, &c., there are small stones with tiles, and at Chester the stones are large. It is not a question of the size of the stones, or the presence or absence of tiles. Did he ever see the wall of a Roman *castrum* built without mortar? * He alludes to the Roman wall, &c., saying I had not considered its large stones. Why the great wall is a solid mass of concrete; the size of the stones is a secondary question. Dr. Bruce, the historian of the wall, has distinctly said that "he did not believe that the Romans ever built a wall without the use of mortar." Mr. Smith will surely accept testimony like this from such a quarter. And with this may be put Mr. Smith's own words on the Chester walls ("Collect. Antiq.," vol. vi., p. 43), "A question naturally arises, not why the prevailing features of Roman mural masonry should be so uniform and so marked, but why that at Chester should form an exception to the general rule." The excavations just made, and those made three or four years since, have answered the question by showing that the wall is not Roman. Mr. Brock, following suit to Mr. Smith's words as above, said in his address at Chester that the Romans had introduced "novelties" into Roman architecture when building this north wall at that place. Has Mr. Brock, any more than Mr. Smith, seen a similar wall in a Roman *castrum?* Has he ever seen in the wall of such a *castrum* a cornice projecting some 18 in. on the exterior, as if purposely to assist an escalade? Or if the Romans had introduced such a feature, would it have been preserved all through the Middle Ages and the Parliamentary war, when it would have been more than ever of advantage to besiegers? Mr. Brock's remarks as to Sir J. Picton I have anticipated in the *Academy* of last week, and replied to in what I have said above on Mr. Smith's letter.

But if this wall be Roman, what will Mr. Brock say to the portion west of the North Gate? In 1883, the inner face of this fell down, and when the necessary repairs were made it was resolved to cut a new passage (or gate) through it. In doing so, it was found that the wall (proper) was, beneath the pavement, nearly hollow; some little distance lower, between the external and internal faces, there was the lower part of an internal older wall, formed of rudely-shaped stones, some 6 in. square, with a quantity of poor mortar, and a "filling in" like the rubble walls of old churches, but percolating water had removed this to the depth of 6 ft., and had thus been the means of bringing down the present interior face. Competent judges decided that this wall was probably Edwardian, but that it could not be earlier than Late Norman. The decayed wall was supported to half its height on the outer face by a much newer and sloping one, acting as a buttress, from 4 ft. to 6 ft. wide at the base, and sloping

* I leave out of the question the town-walls in France, Belgium, &c., which Mr. Smith names as built up of monuments, as the origin of these is disputed.

up to a point, which had never been bonded to the first named. Mr. Shrubsole passed his arm into the space between them. This buttressing wall was composed of fragments of Roman cornices, friezes, split columns, bases, and tombstones, one of the latter, with an inscription in good preservation, being removed from it; with close joints and no mortar, much resembling the wall lately laid bare near the Phœnix Tower. Was this low, sloping, and buttressing wall of earlier date than the wall which it supported? The mouldings were all turned to the inside. Some of the fragments are now in the Museum, and I have engraved them, as well as the inscribed tombstone, in my "Roman Cheshire." Here is an almost exact counterpart of the wall lately laid bare, but will Mr. Brock assert that the buttressing wall was Roman, whilst the main one was beyond all question of Mediæval date? A little beyond this on one of the towers of the wall (Pemberton's Parlour) there is an inscription which tells us that in 1708 "*divers* wide breaches in these walls were *rebuilt* and other *decays* therein were repaired, two thousand yards of the pavement were new flagged or paved, and the whole repaired, regulated, and *adorned* at the expense of one thousand pounds or upwards." The newness of the buttressing wall, it being comparatively little worn, suggests at once that it was part of the reparations named as being effected in 1708, for the breach made by the Parliamentarians was certainly not left open till that date, whilst as to the *adornments* I take the cornice to the east of the north gate to be one of them. The wall here was found some three or four years since to be exactly like what Sir J. Picton has described it a few yards distant, "double, with an interval between. This was pronounced to be Mediæval work of uncertain date." But it was so from the rock surface, and the stones surmounted by the cornice, though Roman, have been removed from elsewhere. And if so many Roman stones were lying about Chester, as King in his "Vale Royal," and even Dr. Stukeley in his "Iter Boreale" inform us, there is little difficulty in understanding that the "buttressing" wall I have spoken of, and the cornice and stones at the North Gate, were among the repairs noticed as taking place in the reign of Anne. I have dwelt upon all these at greater length in "Roman Cheshire." I will not dispute Mr. Brock's measurements, &c., but I have not at present time to go into them. The stone bearing the "ecclesiastical" figure was, I admit, found in the "unmortared" part, near the base of the wall, and near its centre. I hope Mr. Brock will gather from this and my other letter that I believe the newly-excavated portion of the north wall to have been constructed in its present state (or mostly so) immediately after the siege, the North Gate cornice and walls and the "buttressing" wall during the repairs in Anne's reign, whilst as to the Roodeye stones I do not recognise them, either above ground or in the 15 ft. beneath ground (where they are regular), as a wall in any sense. They are outside the Roman area, at the corner of a large creek, where the clay bank would be particularly liable, from the tide of the estuary and the water of the creek, to be gradually washed away, and they have been placed there to prevent it. Perhaps also they may have acted as the abutment of a bridge which crossed the creek, and of which the base of the corresponding abutment, with possibly intervening piers, may yet be found beneath the bank on which the present walls are built. From old maps, the creek was still a large one in Elizabeth's time.

I believe in finding foundations of the Roman walls of Chester, as Mr. Brock does, on the east and north sides, but they will be like those recently discovered on the south side, of boulders set in massive concrete, with possibly the sandstone blocks and tile layers above them.

W. Thompson Watkin.

Liverpool, Sept. 26, 1887.

P.S.—If I were "at all hazards" to advocate the Roman theory, I could find in the removal of the northern wall of the *castrum* to its present line from that of Abbey-court, and consequent enclosure of an extra-mural cemetery ("Roman Cheshire," pp. 87–8), a reason for the presence of Roman tombstones in the northern wall. But that wall is not of Roman work, and at the time the cemetery was inclosed the stones would not be so desecrated.

"SHONE'S EJECTORS IN THE RECENT RAINSTORMS."

Sir,—I have read the letter of your correspondent who styles himself "Miscalled Uncivil Engineer," which appears in your last issue [p. 442], in reply to Mr. John Phillips's letter which appeared in your issue of the 17th inst.

Mr. Phillips's primary object in writing to you was, as I believe, to prove the adequacy of the new works,—(1) from his own point of view as the engineer who originally suggested them; (2) from the point of view of the Select Committee of the House of Commons which elected to act upon his suggestions.

You will agree with me, Sir, that to judge fairly of the success or non-success of the works at the Houses of Parliament, and of the relative worthlessness of the statements of your correspondent, your readers ought to know what I undertook to do at the Houses of Parliament. Because, if I can prove that I have done what I undertook to do for the Government, I fail to see why, except on one hypothesis, your correspondent or anybody else should deny to Mr. Phillips and myself the gratification we think we are justly entitled to enjoy, in explaining to the sanitary world, through you, that notwithstanding the prophecies of a certain clique of engineers to the contrary, the works carried out are, in reality, a great success.

Those of your readers who are really desirous to understand in principle and in detail the nature and character of the important works carried out at the Houses of Parliament, I would respectfully refer to the illustrated "enlarged edition" of a work which I have just published through Messrs. E. & F. N. Spon, descriptive of them.

For my present purpose it is sufficient to say that the maximum quantity of sewage and rainfall in combination, which I stated to the First Commissioner of Her Majesty's Works and Public Buildings, that the four Atkinson gas-engine air-compressors, and the three pneumatic sewage-ejectors, working together, would receive and discharge into the Metropolitan sewer, when that sewer was surcharged with storm-water to the greatest extent ever known or recorded, was 1,200 gallons per minute. Now, the question is this,—Did the gas-engine air-compressors and the pneumatic ejectors discharge this quantity, as Mr. Phillips would have you believe they did, and considerably more, on the 17th ult., when there was a rainfall at the rate of 0·59 in. per hour, or at the rate of 14·16 in. in the twenty-four hours?

I believe they did, because the surface area drained into the ejectors is ten acres, more or less, and this consists for the most part of roofed and paved surfaces over which the rainfall would and does pass extraordinarily rapidly. Of course, if the rain passed from this area to the ejectors as quickly as it fell, the quantity with the sewage would be equal to 2,280 gallons per minute.

Now, whatever the rate was at which that rain reached the ejectors,—and I know from experience it must have been nearly as rapidly as it fell,—the ejectors dealt with the whole of it, with the exception of about 2,000 gallons, as stated by Mr. Phillips. This quantity overflowed, *as it was designed to overflow*, into what remains of the big old sewer, which is retained specially for the temporary storage of such heavy downpours as I am describing. Not a drop got into the basements.

The Meteorological Office at Westminster gives the rainfall as being 0·59 in. only, whilst Mr. Symonds records it as being 1·42 in. in Camden-square, N.W. The data thus obtained furnish incontrovertible proofs that the plant put down at the Houses of Parliament is able to deal with much more than 1,200 gallons per minute,—the quantity which I stated would be the maximum quantity it would deal with.

In this connexion I desire to state that Sir Robert Rawlinson, in his evidence before the Select Committee of the House of Commons appointed to inquire into this subject, gave it as his opinion, that if pumps, when duplicated, were provided to deal with a maximum quantity of 400 gallons per minute, they would be more than sufficient to deal with the rainfalls stated by the officials of Her Majesty's Office of Works, &c., to be the rainfalls that give trouble, &c.

It is manifest, therefore, that, as I provided power to deal with three times this quantity per minute, and more, the works carried out must be deemed to be adequate for all reasonable rainfall emergencies; and, if so, is it not sheer nonsense for your correspondent to write about "the incapacity of the Shone installation to deal with the rainfall"? What rainfall? I ask. Three inches per hour, as stated by your correspondent?

Is there any engineer, in his senses, who would provide pumping power to deal with 3 in. of rainfall per hour, or 11,344 gallons (off the ten acres) every minute, in or out of England?

Your correspondent persists in stating that the inlet and delivery pipes of the Houses of Parliament ejectors are 5 in. in diameter. I ought to know,—and I again assure your correspondent, for the last time, that they are 6 in. in diameter; and as he admitted at the meeting of the Society of Engineers that the installation, as existing at the Houses of Parliament, would deal with 1,000 gallons per minute; and as the capacity of pipes to receive and discharge sewage varies as the square root of the fifth power of their diameters, it follows that the installation after all, according to your correspondent's own calculation, will deal with 1,577 gallons per minute.

Isaac Shone.

Sir,—From your correspondent's letter at p. 442 in last week's *Builder*, he evidently thinks that I was present at the meeting he refers to. I beg to say I was not, and know nothing of the assertions he indulged in at that meeting.

For some years past certain engineers have opposed the adoption of Mr. Shone's ejectors, not by fair criticism, but by distorted statements. It is charitable to suppose that some have done this because they are unacquainted with the true principles and capabilities of the ejectors, and therefore are unable to distinguish right from wrong in regard to them.

Your correspondent has mistaken the 6-in. receiving and discharging pipes of the ejectors for 5-in. pipes. On this false datum he has soared away into the regions of imagination, and it would be unprofitable labour to follow him in his wanderings. The ejectors are now largely in demand, and the more their merits are known and understood, the more they will be employed.

In my former letter, at p. 411 in the *Builder* of the 17th Sept., I described a few undeniable facts in regard to what the ejectors successfully accomplished during a most trying ordeal on the 17th August. It is very likely that during the two minutes when the 2,000 gallons of water overflowed into the subway reservoir, twice the registered rainfall in Westminster came down, namely 2 + ·59 = 1·18 in. per hour, for at Battersea and at Camden Town more than 1¼ in. per hour was registered during the same rain-storm. With the probable rainfall of 1·18 in. per hour, the basements of the Houses of Parliament were not flooded, nor would they have been had 2 in. per hour fallen for a short time, as the subway reservoir would have contained the surplus water which the ejectors could not then have discharged without the head of water therein reaching the basement levels.

Whoever has a desire to know what the performance of the ejectors was on the day referred to,—which was far beyond what they were designed to perform,—would do well to refer to my previous letter.

John Phillips, C.E.

REFUSE DESTRUCTORS AND CREMATORS.

Sir,—My attention has been drawn to a report of the paper read by Mr. Jones, of Ealing, before the Association of Municipal and Sanitary Engineers at West Bromwich. [See *Builder*, p. 360, *ante*.]

I consider Mr. Jones's criticisms on all destructors but one most unfair, and I take it that his paper, as a whole, is more in the form of an advertising lecture than a *résumé* of what has been accomplished by "refuse destructors and their results up to the present time."

I do not intend to wade through the whole of what I term an egotistical production of a self-styled "Author," but rather to refer to the remarks on the system named the "Beehive," which I have patented.

Mr. Jones says, "In the valuable digest prepared by Mr. Clavey, of Burton-upon-Trent, for his Board in 1886, under the head of Burnley, where the 'Beehive' was born, in answer to the query as to whether 'the destructor gives satisfaction,' the reply is, 'It gives every satisfaction'; but on turning to Leicester, where it was in the hands of one of our most experienced officers, I find the reply to the same question as follows, 'That the "Beehive" does not give satisfaction.'"

Now, Mr. Jones throws a doubt on the accuracy of the reply from Burnley, but I can inform him that the answer above quoted is perfectly correct, and was returned by me, and I defy Mr. Jones or any other person who has visited Burnley and inspected the "Beehive" to give any evidence to the contrary.

He also refers to Richmond and Bradford, but has not been sufficiently explicit in his details to show the reason why the "Beehive" has failed at these places; and I consider this a want of fairness on his part. Nor can I understand how Mr. Jones should be of the opinion, through his visit to Burnley, that the destructor was not a success; though I can now account for its non-success at Richmond, when it has to be judged by a critic who had an interest in another similar invention.

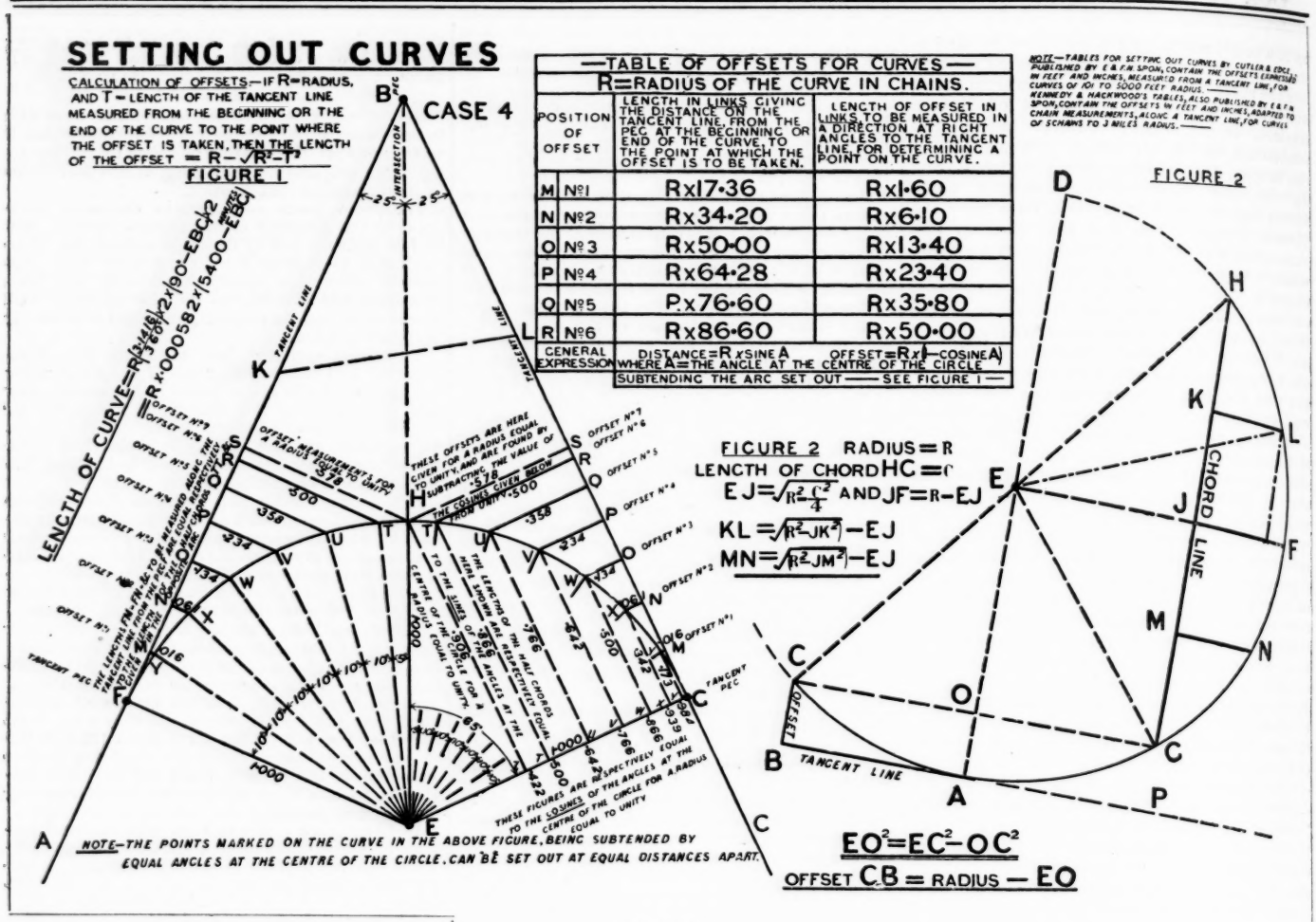
How is it Mr. Jones has not told us more about his own cremator and its working at Blackburn?

In looking over the columns of the *Blackburn Standard* of February 5th, 1887, I find these remarks applied to the so-called "Cremator":—"Since the last Council meeting I have examined the Cremator, and found it doing little or no work at all. The nuisance was as bad that week as it was before."

This is a quotation from one of the Councillors of that town, and I presume it applies to this celebrated Cremator as patented by Mr. Jones, who went to Blackburn to inspect it after its erection in December last, and approved of its working.

In conclusion, I consider that if Mr. Jones wishes to criticise inventions, he should go into all the facts of the case, and not pick out matters detrimental to one and of value to others.

John E. Stafford.


SETTING OUT CURVES
CALCULATION OF OFFSETS.—IF R=RADIUS, AND T=LENGTH OF THE TANGENT LINE MEASURED FROM THE BEGINNING OR THE END OF THE CURVE TO THE POINT WHERE THE OFFSET IS TAKEN, THEN THE LENGTH OF THE OFFSET = R−√(R²−T²)
FIGURE 1
CASE 4
—TABLE OF OFFSETS FOR CURVES—
R=RADIUS OF THE CURVE IN CHAINS.
POSITION OF OFFSET
LENGTH IN LINKS GIVING THE DISTANCE ON THE TANGENT LINE, FROM THE PEC AT THE BEGINNING OR END OF THE CURVE, TO THE POINT AT WHICH THE OFFSET IS TO BE TAKEN.
LENGTH OF OFFSET IN LINKS TO BE MEASURED IN A DIRECTION AT RIGHT ANGLES TO THE TANGENT LINE FOR DETERMINING A POINT ON THE CURVE.
M №1 Rx17·36 Rx1·60
N №2 Rx34·20 Rx6·10
O №3 Rx50·00 Rx13·40
P №4 Rx64·28 Rx23·40
Q №5 Rx76·60 Rx35·80
R №6 Rx86·60 Rx50·00
GENERAL EXPRESSION DISTANCE=R x SINE A OFFSET=Rx(1−COSINE A) WHERE A=THE ANGLE AT THE CENTRE OF THE CIRCLE SUBTENDING THE ARC SET OUT —— SEE FIGURE 1 ——
NOTE—TABLES FOR SETTING OUT CURVES BY CUTLER & EDE, PUBLISHED BY E & F.N. SPON, CONTAIN THE OFFSETS EXPRESSED IN FEET AND INCHES, MEASURED FROM A TANGENT LINE, FOR CURVES OF 101 TO 5000 FEET RADIUS —— KENNEDY & HACKWOOD'S TABLES, ALSO PUBLISHED BY E & F.N. SPON, CONTAIN THE OFFSETS IN FEET AND INCHES, ADAPTED TO CHAIN MEASUREMENTS, ALONG A TANGENT LINE, FOR CURVES OF SCHAINS TO 3 MILES RADIUS. ——
FIGURE 2
FIGURE 2 RADIUS=R
LENGTH OF CHORD HC=C
EJ=√(R²−C²/4) AND JF=R−EJ
KL=√(R²−JK²)−EJ
MN=√(R²−JM²)−EJ
EO²=EC²−OC²
OFFSET CB = RADIUS − EO
NOTE—THE POINTS MARKED ON THE CURVE IN THE ABOVE FIGURE, BEING SUBTENDED BY EQUAL ANGLES AT THE CENTRE OF THE CIRCLE, CAN BE SET OUT AT EQUAL DISTANCES APART.

THEATRE DOORS.

Sir,—Your correspondent "Playgoer," in his otherwise admirable letter [p. 442, *ante*], is mistaken in saying that the form of door-fastenings arranged by me at Mr. Walter Emden's suggestion "is no new idea."* You were good enough to inspect the full size model of the arrangement, and as a result of that inspection the *Builder* says that the invention "is entirely new in the principle and manner of working it."

The object sought and now obtained was to have a concealed fastening which (1) would give way upon pressure being applied against the inside of the door; (2) could not be opened from the outside except by its own key; but (3) could never be locked, either on the inside or the outside, so as to prevent inside pressure opening the door.

If your correspondent will kindly call here and see the simple apparatus he will be in a better position to judge of its merits; or if he will state where such doors, as he thinks, have previously been in use, I shall be glad to inspect them and see wherein the new door differs.

George Hayter Chubb.

"DESIGNING WROUGHT AND CAST IRON STRUCTURES."

Sir,—I thank your reviewer for pointing out some printers' and clerical errors in Part iv. of "Designing Ironwork." $\frac{Wl}{70}$ on p. 6 should be $\frac{Wl}{270}$ the constant being taken from previous notes of actual weights. The other corrections are self-evident.

I do not wish to retort with a "*tu quoque*," but in the review ⊢ should be H; p. 12 should be p. 24; and the reference to p. 13 is imaginary.

Henry Adams.

*** We are glad to receive the author's correction of the formula upon page 6. Our other references to pages agree with the copy sent to us; but we acknowledge that the section shown thus ⊢ by our printers was intended by us to be thus, H, as pointed out by Mr. Adams.

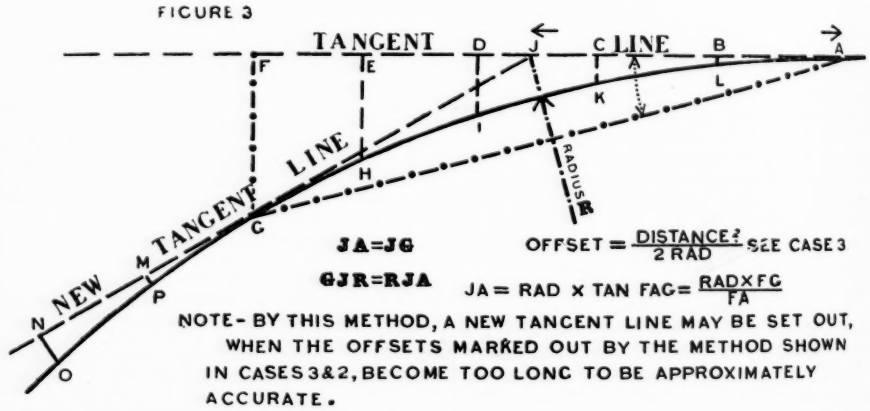
SELENITIC MORTAR.

Sir,—Our attention has been called to the advice given in Mr. Leaning's book, "The Duties of a Clerk of Works," to "avoid use of selenitic lime for lathed work," and to "Architect's" letter which appeared in your issue of Sept. 10th [p. 378].

We find that practical plasterers who understand the use of selenitic, entirely concur in "Architect's" views, and are strongly in favour of using this material with proper proportions of hair and putty for both the pricking-up and the floating coats on lathed work.

* We pointed this out in our comment on "Playgoer's" letter.—Ed.

FIGURE 3


TANGENT LINE
TANGENT LINE
NEW TANGENT LINE
JA=JG
GJR=RJA
OFFSET = DISTANCE²/2 RAD SEE CASE 3
JA = RAD X TAN FAG = RAD×FG/FA
NOTE- BY THIS METHOD, A NEW TANGENT LINE MAY BE SET OUT, WHEN THE OFFSETS MARKED OUT BY THE METHOD SHOWN IN CASES 3&2, BECOME TOO LONG TO BE APPROXIMATELY ACCURATE.

Capital work of this kind is being done with selenitic every day, and we suspect some bad work, done either by inexperienced men or with an inferior quality of selenitic, is the cause of Mr. Leaning's veto.

Charles Nelson & Co., Limited,
Manufacturers of Selenitic Cement.

ARCHITECTURAL ASSOCIATION.

Sir,—Will you kindly allow us to call attention through your journal to the *elementary* class for the study of decoration and ornament, which will be commenced this session under the guidance of Mr. Cole A. Adams. The first meeting will be held at No. 9, Conduit-street, on Thursday, October 13th, at 6·30 p.m., when the course of study to be pursued will be explained. Students wishing to join should send in their names at once to the Secretary, Mr. Walter H. Hewish, 14, Holden-terrace, Grosvenor-gardens, S.W. The fees and rules will be similar to those of the other elementary classes.

Thos. Edward Pryce,
Frederic R. Farrow, } Hon. Secs.

The Student's Column.

LAND SURVEYING AND LEVELLING.

XIV.—SETTING OUT CURVES.

WHERE great accuracy is not required, the application of the formula derived from Case 1 may be adopted, by the method shown in Case 3, for setting out offsets at right angles to a tangent line. The first offset nearest the junction of the curve with the tangent line is thus easily calculated, being equal to the length measured along the tangent line, divided by twice the radius of the curve (see fig. 3), and if the remaining offsets be set out at the same distance apart, measured along the tangent line, the succeeding offsets, Nos. 2, 3, 4, and 5, will be respectively equal in proportion to the square of these numbers, or 4, 9, 16, and 25 times the length of the first offset. As the middle point in the curve is approached, the tangential angle between the chord and the tangent line increases, and the amount of error in the length of the offset so calculated will also be increased. This error can, however, be kept small by setting out a new tangent line as shown in fig. 3.

When the angle formed at B is smaller than that shown in Case 4, fig. 1, it will probably be found a more convenient mode for setting out the curve, to adopt one of the following methods:—(1) In the case of a radius not greater than one chain, to divert one or both or a portion of one of the lines A B and B C, making them parallel to one another. Then mark out a semicircle between them by twisting the chain round from the centre of a line set out at right angles to the tangent lines, which line will join the beginning with the end of the curve. (2) In the case of a radius over one chain in length, join any two points K and L in the tangent lines B A and B C, and calculate the lengths B K and B L in fig. 1, from the following formulæ:—

$$B K = K L \frac{\text{sine } B L K}{\text{sine } A B C}$$

$$B L = K L \frac{\text{sine } B K L}{\text{sine } A B C}$$

Then proceed as in Case 3. If the tangent

points F and G be joined by a chord line F G the curve might also be set out by offsets measured from the chord, as shown in Case 4, fig. 2. The middle point J is found by measuring the length of the chord H G and bisecting it. The distance J M or J K to the points M or K at which offsets are required is next measured, and the square of the distance is subtracted from the square of the radius. The square root of the result is then determined, and from it is subtracted the square root of the radius squared minus half the chord squared. This is expressed in the formulæ given upon the diagram.

If the point of intersection of the tangent lines is inaccessible the application of the formulæ for finding the distances B K and K L (fig. 1) becomes necessary when Case 3 or Case 4 is to be adopted. Where obstructions occur upon the line of the curve itself, the application of the method shown in Case 4, fig. 2 is often advisable.

In fig. 1 the true measurements for setting out a curve are given, the distances along the tangent line from the beginning or end of the curve being respectively equal to the half chords, or the sines of the angles at the centre of the circle for a radius equal in length to a single unit; while the length of the offsets at right angles to the tangent lines are found by subtracting from a unit of measurement the value of the cosines of the angles at the centre of the same circle. If, as shown in fig. 1, the angles taken at the centre of the circle be equal,—that is, if the angles taken be subtended by equal chords,—the points marked upon the curve will be at equal distances apart. If T = the distance in links measured along the tangent line by the chain the offset to be measured by a tape or rod will amount to $R-\sqrt{R^2-T^2}$ expressed in links. Tables are published in a form suitable for carrying in the pocket which give the length of various offsets at stated distances for different radii.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

11,766, Apparatus for Inducing Draught in Chimneys. T. Carter and W. B. Tully.

According to this invention, compressed air or steam forced through jets inside the funnel or chimney is used to induce a current of air for draught or ventilation.

13,436, Improvements in Spirit Levels. J. W. Harrington.

This invention consists of a slide, made of brass or horn for protecting the glasses of spirit levels. This is fixed underneath the face-plate immediately over the spirit-glass. The slide is sometimes used for protecting the glass only; or it may, if desired, be made the whole length of the level, in which case it is used and figured as a scale.

13,555, Ventilation of Buildings. J. Horrocks.

The idea of this invention is to pump fresh air along pipes of any length by means of a steam or other engine fixed at one end. Means are taken to disinfect and deodorise the air as it passes through the pipes. The system is to be worked in sections, and the air being turned in at one end the foul air is forced out by the fresh pure air and escapes into the atmosphere by means of a tall stack or such-like appliance. It is thought possible to bring to the City of London country air for the better ventilation of dwellings.

13,698, Door Furniture. J. Brownrigg.

By this invention a small bush with a flange is secured to the door. The rose is then fixed against it flush with the face, but with the bush protruding. A screw spindle is pushed through the door, and an outer loose rose is screwed along the spindle against the fixed rose. The face of this loose rose is slightly sunk to receive a thin washer and the shoulder of the loose knob. When these are screwed tightly up all works smoothly, and the action is simple and durable.

16,105, Outlet Ventilators. J. Craig.

The bottom part of the ventilator is formed of an oblong funnel, the top of which is divided into about three equal parts, one part on each side, covered in an angular direction, which forms the roof. A funnel is fixed on the inside of the ventilator divided into two or more compartments, according to size of the ventilator. An intercepting channel is inserted into the bottom funnel in a position to catch anything that may descend from the top funnel and discharge the same at the open outlets at each end.

9,817, Material for Covering Walls on Floors.

By this invention it is claimed that paper of a kind more than usually suitable to receive embossed patterns is made of wood pulp and straw pulp in varied proportions, as different degrees of hardness or resiliency are required. The pulp mixture is made into strong paper, in the usual way, and this paper, before it has dried and set, is embossed by pressing rollers or pressing blocks. When dried the pattern or protuberances retain their form. Felt or fabric may be cemented on or between layers of the paper.

10,250, Wood Screws. C. D. Rogers.

According to this patent, the diameter of the core or bottom of the screw (at the commencement of the screw thread nearest the head) is made to gradually increase up to its intersection with the head, thereby forming a conical shank. The thread is of the coarse gimlet kind most useful for wood screws.

NEW APPLICATIONS FOR PATENTS.

Sept. 16.—12,570, W. Foster, Connecting Pipes to Water-closet Basins, &c.

Sept. 17.—12,603, W. Baird, Fastenings for Doors of Theatres, Halls, &c.—12,614, J. Hird and J. Ford, Casement Windows and Doors.—12,618, P. Ayton, Combined Door Springs and Pneumatic Checks.—12,632, J. Lyman, Paint.—12,638, A. Rammage, Flooring or Decking for Bridge Work and Building Construction.—12,640, F. Barnett, Self-lowering Metallic or other Fireproof Material Shutters for Prosceniums of Theatres.

Sept. 19.—12,654, H. Lomax, Fasteners for Windows and Doors.—12,691, L. Chinnery, Window Sash Silencer.—12,695, C. Groombridge, Automatically Closing Gates and Doors.—12,710, D. Grove, Portable Buildings.

Sept. 20.—12,765, M. Samuel, Plastic Compound for the Production of Moulded and Decorated Tiles, Slabs, &c.—12,768, W. Lake, Sash Lock and Fastener.—12,775, W. Manders, Red or White Faced Stock Bricks.

Sept. 21.—12,817, M. Clarke, Fireproof Curtains for Theatres, Music Halls, &c.—12,821, S. Pitt, Weather Guard for Doors, Windows, &c.

Sept. 22.—12,857, H. Waddington, Ventilator.—12,864, J. Lyman, Roofing Material.—12,872, M. Blanchard, Bricks for Wells, &c.

PROVISIONAL SPECIFICATIONS ACCEPTED.

9,939, P. Born, Cooling the Air in Rooms, &c.—10,426, T. Moore, Lifters and Fasteners for Skylights, Window Sashes, &c.—10,642, G. Redfern, Preventing the Leakage of Water around Chimney or other Pipes passing through the Roofs of Buildings.—11,039, J. Kenyon and Others, Preventing Passage of Wind, Rain, or Dust beneath Doors.—11,109, J. Carrett, Chimney Top.—11,686, J. Tomkys, Attaching Door-knobs to Spindles.—10,284, J. Wilson, Walls, Buildings, Floors, Chimneys, &c.—10,436, J. Wilson, Walls, Buildings, Floors, &c.—11,283, W. Bull, Roofing Tiles, &c.—11,509, H. Warrington and W. Howlett, Bricks and other Blocks for Building Purposes.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

13,452, J. Hont, Fitting, Ornamenting, and Decorating Shops, &c.—14,491, R. Henry, Sash-line Fasteners.—14,939, E. Smith, Regulating the Supply of Water to Closets, &c.—15,038, J. Gregson, Rain-water, Soil, and Stove Pipes, and Fixing same.—15,546, A. Henderson, Syphon Trap Closet Pans.—16,708, M. Syer, Syphon Cisterns for Flushing Closets, &c.—8,965, R. Gamble, Burglar Alarm Detector for Windows, &c.—11,297, H. Lake, Door Latches.—11,339, E. Finch, Syphon Flushing Cisterns.—14,223, J. Tall, Concrete Wall Construction.—14,442, A. Henderson, Fixing Door-knobs to Spindles.—15,184, G. Stierlin, Fanlights, Windows, Ventilators, &c.—15,312, G. Ewing, Flushing Apparatus for Water-closets, &c.—15,628, H. Walker and R. Carey, Hydraulic Lifts.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

September 9.

By Driver & Co. (at Exeter).

South Devon, near Totnes—Washbourne Barton Farm, containing 202a. 0r. 35p., freehold £10,000

September 21.

By Joshua Baker & Son.

Pinner, Middlesex—Down's Farm, containing 94a. 2r. 35p., freehold 7,200

Battersea—35, 37, and 39, Falcon-road, 92 years, ground-rent 21*l.* 15s. 1,775

Herne Hill—57, Shakespeare-road, 79 years, ground-rent 5*l.* 450

By C. A. Richards.

Holborn—2, Castle-court, freehold 355

By E. & S. Smith.

Lisson-grove, Orcus-street—Improved ground-rents of 100*l.* 8s. per annum, 34 years 1,010

Clerkenwell—16, Lloyd-square, 34 years, ground-rent 10*l.* 450

By Ellis, Morris, Sutherland, & Co.

Maidenhead, Ray Park—The residence, "Seaforth Lodge," 77 years, ground-rent 10*l.* 1,420

September 22.

By Farebrother, Ellis, Clark, & Co.

Plymouth—The Promenade Pier 12,000

By Douglas Young.

Pimlico—7, Churton-place, 42 years, ground-rent 6*l.* 490

Stockwell—45, Aytoun-road, 60 years, ground-rent 9*l.* 200

By Newbon & Harding.

Kensington—32 and 33, Edwardes-square, 22 years, ground-rent 4*l.* 10s. 920

Islington—24, Wellington-street, 44 years, ground-rent 8*l.* £400

King's-cross—17 to 22, North-avenue, 47 years, ground-rent 21*l.* 560

Barnsbury—20, Offord-road, 63 years, ground-rent 1*l.* 490

September 23.

By Baker & Sons.

Sussex, Slinfold—Freehold farm buildings, and 254a. 3r. 36p. 4,640

Brondesbury, Salisbury-road—The residence called "The Oaks," 91 years, ground-rent 15*l.* 15s. 1,090

Spitalfields, Lamb-street—Freehold ground-rent of 20*l.* per annum, reversion in 6¼ years... 870

High Holborn—A profit rental of 250*l.*, increasing in four years to 300*l.* per annum, 42 years, ground-rent 50*l.* 4,270

MEETINGS.

Monday, October 3.

Society of Engineers.—Mr. R. J. Hutton on "Stability of Factory Chimneys." 7·30 p.m.

Clerks of Works' Association (*Carpenters' Hall*).—General quarterly meeting. 8 p.m.

Tuesday, October 4.

Parkes Museum (*Lectures for Sanitary Inspectors*).—Dr. Louis Parkes on "Water Supply, Drinking Water, Pollution of Water." 8 p.m.

Wednesday, October 5.

University College.—Professor Roger Smith's Opening Lecture in Architecture. 7·30 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary meeting. 8·30 p.m.

Liverpool Engineering Society.—Mr. F. Hudleston on "The Coal Shipping Appliances of the Port of Liverpool."

Friday, October 7.

Architectural Association.—*Conversazione* at the Westminster Town-hall. 8 p.m.

Parkes Museum (*Lectures for Sanitary Inspectors*).—Professor H. Robinson on "Drainage Construction." 8 p.m.

Miscellanea.

The Pulsometer Engineering Company are about to bring out a new and simple automatic pumping-machine for lifting sewage or other liquids from one level to another. The machine is likely to be of much service in town sewerage works where difficulties of level have to be encountered. The machine is worked, at a very small expenditure, by the pressure of water obtained from the street water-main. It is automatic in action. The presence of sewage is necessary to set it working, but when the flow of sewage ceases the pump comes to a standstill. We have this week seen one of these machines in action at the Company's Works, Nine Elms, Vauxhall. At the same time, we had an opportunity of noting the great adaptability to almost all conceivable conditions of contractors' work, of this Company's now well-known pumping appliance, the Pulsometer, which requires no staging, but can be slung or suspended down a shaft, or in any other situation, the steam-pipe being led down to it. Their deep-well pumping engine, "The Deane," is direct acting, and is admirably adapted for raising water from contracted shafts, artesian wells, &c. Another speciality of the Company is the "Thames Filter," the filtering medium being sponge, which is cleansed by simple mechanism. A large installation of these filters has been fixed at the works of the London Hydraulic Power Company, where about 10,000 gallons of water per hour of Thames water are filtered by them to a defined standard of purity, thus saving the heavy cost of a supply from one of the water companies. Filters for swimming-baths and other purposes are also made by the Company.

A New Gas Boiler for Conservatories.—Mr. G. Shrewsbury, of Newgate-street, has lately brought out a new gas boiler for conservatories, which he calls the "Reliance." Now that the sharp frosty nights are approaching this boiler, it appears to us, will be found well worth examination. It is claimed for it that it may be placed in perfect safety *inside* the conservatory, as there is an equal pressure of air on the inlet and outlet pipes. The outer case of the boiler is made air-tight, and all the air for the supply of the burner is drawn down the inlet pipe from outside the conservatory and is led into the bottom of the air-tight outer case of the boiler. The pipe for the escape of the products of combustion is led out of the top of the case, thus keeping up a syphonic action in the pipes and case, maintaining the pure air in the conservatory. This boiler was patented as recently as July last, but was previously carefully tested throughout the whole of last winter by the patentee in his own conservatory, and found to answer well, we are informed, under all conditions and changes of weather.

Sale of Building Land at Cromer.—On Monday last a large and important sale of building sites,—the second during the present season, took place at Cromer, where a considerable impetus is at the present time being given to building, not only within the area of the old seaside town itself, but also in the neighbourhood immediately around. The property submitted to competition on Monday comprised the second portion of the Suffield Park Estate, belonging to Lord Suffield. It consisted of 142 lots, divided into sites of various sizes, for the erection of different classes of houses, the frontages ranging from 15 ft. to 40 ft., with corresponding depths, three of the plots, which were exceptionally large, having frontages of 50 ft., 93 ft., 130 ft., and 155 ft. The property offered is situated in a charming valley, with the Lighthouse Hills and the rugged and majestic cliffs immediately to the north-east commanding a picturesque view of the German Ocean, with the shore nearly 100 ft. below the lofty cliffs, the scenery inland to the south-east and south-west being equally picturesque. Messrs. Baker & Sons conducted the sale, in conjunction with Messrs. Spelman, land agents, of Norwich and Yarmouth. Mr. Baker, in introducing the property, enlarged upon the natural beauties and attractions of Cromer, which, he observed, was fast becoming the most favourite watering-place on the north-east coast. On the sale proceeding every lot was rapidly purchased, the smaller lots, having 15 ft. frontages, averaging about 12*l.* each; those having 20 ft. frontages 15*l.* each; those with 25 ft. frontages from 31*l.* to 32*l.* each; and those having 30 ft. frontages from 40*l.* to 45*l.* each. An hotel plot having a frontage of 57 ft., and a return frontage of 90 ft., realised 100*l.*, and the three large plots above referred to were sold for 135*l.*, 140*l.*, and 145*l.* each. The entire proceeds of the sale amounted to about 3,800*l.*

Economic Geology.—A series of thirty lectures on this subject is to be commenced by Mr. G. F. Harris, F.G.S., at the Birkbeck Institute, on Wednesday evenings, commencing October 5. The lectures are intended especially to give practical as well as theoretical geological information to architects, civil and mining engineers, builders, &c., and deals, among other subjects, with the selection of stone for building purposes, experiments in testing durability of stone, crushing weight, absorption of water, chemical and microscopical analysis, weathering, &c.; the distribution and shape of the water-bearing and non-water-bearing strata in England and Wales; water-supply from lakes and rivers; reservoirs, analyses of water, rainfall, filtering; canal and railway cuttings and embankments, landslips, faults, and drainage; concrete, cement, lime-kilns, mortar, &c.

Lightning Conductor Tests.—Amid some disputes about lightning conductors recently by people who do not all know what they are talking about, the following from a letter signed "J. A. Fleming" in a recent number of the *Times* is a suggestion worth keeping in mind:—"Not only is it necessary to have a properly fitted conductor or system of conductors to every valuable building, but it is above all things necessary to have a periodical electrical test applied to the conductor in order to ascertain if the earth plate is making 'good earth.' The proper manner of doing this is to run a second isolated cable parallel to the conductor and making contact with it near the top. This testing cable should have a separate earth plate. A simple electrical test, applied easily, will then enable an observer to state whether that conductor is an efficient lightning protector, or only an additional source of danger."

A New Italian Canal.—Two members of the Italian Parliament, Signori Fazzari and Morandin, have presented to their Government a plan for a new canal, navigable for large vessels, through the province of Catauzaro, whereby ships bound from the Tyrrhenian into the Ionian Sea will save the detour around Sicily, or the passage through the Straits of Messina. The canal would be thirty-five miles in length, and will follow the course of the rivers Amatoo and Corucus, and by regulating the waters of these two rivers it is estimated that 80,000 hectares of land will be reclaimed, an area sufficient to cover the interest on the capital required for the construction of the canal. The new waterway, the promoters maintain, would be of great value to vessels trading in the Levant and Black Sea.

Engineering, &c., at University College, London.—We notice from the prospectus of University College, London, Engineering Department, that the work of this College commences for the Session on the 5th of October. The instruction in Surveying and the lectures in the various branches of Civil Engineering are given by Prof. L. F. Vernon-Harcourt. The general lectures on Engineering and Machine Design, as well as the work in the engineering laboratory, are in the hands of Professor Alex. W. Kennedy. In this laboratory, the arrangements of which formed a principal subject of the paper on "The Use and Equipment of Engineering Laboratories," read by Professor Kennedy before the Institution of Civil Engineers last winter, students go through for themselves during the session a systematically-arranged course of experimental work in connexion with elasticity and the strength of materials, the efficiency and economy of steam boilers and engines, the appliances for which have been considerably extended during the last few months. Electrical Technology is under the care of Professor Fleming, by whom (with Professor Carey Foster) a dynamo installation has lately been fitted up for the purpose of practical experimentation in "applied electricity." Economic Geology is treated as a special subject in a short course of lectures by Professor T. G. Bonney, and Chemistry as applied to Engineering and Architecture in a course by Professor Charles Graham. In addition to these matters directly connected with engineering, the College provides ample instruction in all the sciences on which engineering is based, mathematics, mechanics, physics, chemistry, geology, &c., and very special attention is given to graphic methods of calculation as applied to scientific and technical problems in the lectures and drawing class of Professor Karl Pearson.

The Sanitary Condition of Large Cities. Dr. Jacques Bertillon, chief of the Paris Bureau of Statistics, publishes in the *Revue d'Hygiène* a comparative statement of the sanitary condition of the chief European and American cities during 1886. The author gives the proportion of deaths per 100,000 of the living population for certain preventible diseases. The proportion of deaths caused by typhoid fever was as follows for French cities:—Besançon, 205; Toulouse, 118; Marseilles, 108; Nancy, 65; Bordeaux, 60; Paris, 46; Lyons, 40. These are high figures as compared with those for certain cities of other European countries. The proportion per 100,000 was, in Liverpool, 34; Manchester, 33; Brussels, 29; Dresden, 18; London, 17; Amsterdam, 16; Berlin, 16; Edinburgh, 15; Copenhagen, 13; Leipzig, 11; Vienna, 11. A few large cities, however, suffered more severely from this disease. At Saragossa the proportion was 128; St. Petersburg, 113; Milan, 71; Philadelphia, 65; Baltimore, 46. The great outbreaks of smallpox during the past year are shown by the following figures, giving the number of deaths per 100,000 of the population, viz.:—Marseilles, 573; Buda-Pest, 358; Saragossa, 221; Rome, 128; Rheims, 110; Zürich, 106; Milan, 64. Some of the figures for scarlet fever were:—Hanover, 285; Buda-Pest, 127; St. Petersburg, 93; Glasgow, 68; Leeds, 57; Brooklyn, 51; Liverpool, 47; München, 34; Leipzig, 28; Berlin, 21; Paris, 18; London, 17; Vienna, 16; Lyons, 13; Amsterdam, 6; Marseilles, 5; Rome, 5. For diphtheria some of the figures were:—Grenada, 491; Nürnberg, 240; Brooklyn, 170; Dresden, 169; Marseilles, 163; Berlin, 128; Buda-Pest, 128; Hamburg, 123; Philadelphia, 113; Leipzig, 110; München, 86; Amsterdam, 74; Paris, 73; St. Petersburg, 63; Rome, 52; Lyons, 38; London, 33; Edinburgh, 32; Glasgow, 29; Liverpool, 21. The above diseases appearing generally in epidemic form, an otherwise healthy city may show a large death-rate for any particular year. It is otherwise with such diseases as consumption, for instance, of which Dr. Bertillon gives statistics, which do not vary much from year to year. The highest proportion occurred at Buda-Pest, where 708 died of the disease in 100,000 inhabitants. Then follow Vienna, with 664 deaths; Nürnberg, 482; Paris, 470; Marseilles, 448; Lyons, 444; München, 390; Dresden, 387; Berlin, 334; Brussels, 315; Leipzig, 315; Rome, 212. Of American cities, New Orleans had the highest death-rate, 382; Brooklyn following, with 313; and Philadelphia, with 296 deaths per 100,000. With the exception of Belfast, where the proportion was 472, the large cities of the United Kingdom show very favourably compared with Continental cities, Glasgow having but 278; London, 202; and Edinburgh, but 193 deaths from consumption out of 100,000 inhabitants. The figures given above,—taking into account changes which have been mostly for the better,—prove that the greatest mortality from consumption exists in large Austrian cities, the smallest in English cities. The death-rates from scarlet fever were highest in Germany, from diphtheria in Spain and Germany, from small-pox in France and Austria, from typhoid fever in France and Spain. It is satisfactory to find that the death-rates from all the causes mentioned in English cities are amongst the lowest.

Schools, Formby, Lancashire.—The schools attached to St. Mary's R.C. Church, Formby, have recently been enlarged, and two additional class-rooms have been built in the same style as the existing buildings. Crosby light pink bricks have been used for the general walling, with Edwards's Ruabon red and blue bricks in strings, arches, buttress, weatherings, &c. The interior is plastered throughout with a cemented dado. Roof principals are exposed, stained, and varnished. The work has been carried out by Mr. Edward Blackburn, builder, of King's-road, Bootle, from plans by and under the superintendence of the architect, Mr. Fred. H. Peate, of Liverpool.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	6	0	0	7	10	0
Teak, E.I. ....load	8	0	0	13	0	0
Sequoia, U.S. ....foot cube	0	2	3	0	3	0
Ash, Canada ....load	3	0	0	4	10	0
Birch ,, ...	2	0	0	3	10	0
Elm ,, ...	3	10	0	4	10	0
Fir, Dantsic, &c.	1	10	0	4	0	0
Oak ,, ...	2	10	0	4	10	0
Canada	3	0	0	6	0	0
Pine, Canada red	2	0	0	3	10	0
,, yellow	2	0	0	4	0	0
Lath, Dantsic ....fathom	3	0	0	5	0	0
St. Petersburg	4	0	0	5	10	0
Wainscot, Riga ....log	0	0	0	0	0	0
,, Odessa, crown....	2	10	0	3	0	0
Deals, Finland, 2nd and 1st...std.100	7	0	0	8	0	0
,, 4th and 3rd	5	10	0	6	10	0
Riga	5	10	0	7	0	0
St. Petersburg, 1st yellow	8	0	0	13	0	0
,, 2nd ,, ...	7	0	0	8	0	0
,, white	6	10	0	8	10	0
Swedish	6	0	0	14	0	0
White Sea	0	0	0	0	0	0
Canada, Pine, 1st	16	0	0	24	0	0
,, ,, 2nd....	10	0	0	15	0	0
,, ,, 3rd, &c....	6	0	0	9	0	0
,, Spruce, 1st	8	0	0	9	0	0
,, ,, 3rd and 2nd	5	0	0	7	0	0
New Brunswick, &c....	5	0	0	6	10	0
Battens, all kinds	4	0	0	10	10	0
Flooring Boards, sq., 1 in., prepared, First	0	8	0	0	11	0
Second	0	6	6	0	7	6
Other qualities	0	4	0	0	6	0
Cedar, Cuba ....foot	0	0	3½	0	0	3½
Honduras, &c.	0	0	3	0	0	3½
Australian	0	0	2	0	0	3
Mahogany, Cuba	0	0	4	0	0	6½
St. Domingo, cargo average	0	0	4	0	0	5½
Mexican ,, ...	0	0	3½	0	0	3½
Tobasco ,, ...	0	0	3½	0	0	5
Honduras ,, ...	0	0	3½	0	0	5
Maple, Bird's-eye	0	0	5	0	0	7
Rose, Rio ....ton	8	0	0	11	0	0
Bahia....	7	0	0	9	0	0
Box, Turkey ....ton	5	0	0	12	0	0
Satin, St. Domingo ....foot	0	0	5	0	0	9
Porto Rico	0	0	6	0	0	10
Walnut, Italian	0	0	3½	0	0	5½
METALS.						
Iron—Bar, Welsh, in London...ton	4	15	0	5	0	0
,, ,, in Wales	4	2	6	4	10	0
,, Staffordshire, London	5	10	0	6	0	0
Copper—						
British, cake and ingot ....ton	43	10	0	44	0	0
Best selected	44	10	0	45	10	0
Sheets, strong....	50	0	0	0	0	0
Chili, bars	39	10	0	39	17	6
Yellow Metal....lb.	0	0	4½	0	0	4½
Lead—						
Pig, Spanish ....ton	11	17	6	0	0	0
English, common brands....	12	2	6	0	0	0
Sheet, English	13	2	6	0	0	0
Spelter—						
Silesian, special ....ton	15	10	0	15	12	6
Ordinary brands....	15	7	6	15	10	0
Tin—						
Straits....ton	102	15	0	0	0	0
Australian	103	0	0	0	0	0
English ingots	106	0	0	0	0	0
OILS.						
Linseed ....ton	19	15	0	20	0	0
Cocoanut, Cochin	31	0	0	32	0	0
Ceylon	23	15	0	0	0	0
Palm, Lagos	22	0	0	0	0	0
Rapeseed, English pale	24	15	0	25	0	0
,, brown	23	5	0	23	10	0
Cottonseed, refined	21	10	0	0	0	0
Tallow and Oleine....	25	0	0	45	0	0
Lubricating, U.S....	5	0	0	6	0	0
,, refined....	5	0	0	13	0	0
Turpentine—						
American, in casks ....cwt.	1	4	9	0	0	0
Tar—						
Stockholm ....barrel	0	14	0	0	14	6
Archangel	0	9	6	0	9	9

COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Free Public Library	Borough of Middleton...	Not stated	Not stated...	ix.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Wood-Paving Works	Westminstr Bd. of Wks	G. R. W. Wheeler	October 5th	ii.
Construction of Roads, Sewers, &c.	Nat. Standard Land Co.	*Official*	October 10th	ix.
Erection of Urinals	West Ham Council.....	Lewis Angell.....	October 11th	ix.
Fire Apparatus	Southgate Local Board	C. G. Lawson.....	do.	ix.
Broken Granite	do.	do.	do.	ix.
Paving Footways, &c.	Greenwich Bd. of Wks.	*Official*	October 12th	ix.
Road-Making and Paving Works	Hammersmith Vestry...	do.	do.	ix.
Market Place, &c.	Hemel Hempsted Town Improvement Com.	G. & W. R. Low	October 22nd	ix.
Public Memorial Clock, Hindley, near Wigan	.....	.....	Nov. 1st	ii.
4 h.-p. Steam Boiler, for Heating Apparatus	Schl. Board for London	*Official*	Not stated...	ix.
Rebuilding Residences, Cadogan-place	.....	W. M. L. Seaman	do.	ii.
Erection of Scarborough Constitutional Club	.....	H. A. Cheers.....	do.	ii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Clerk of Works	S. Shields, &c., Burial B	Not stated	October 5th	xiv.
Surveyor and Engineer	Tottenham Local Board	400*l.*	October 11th	xiv.

TENDERS.

ARNOLD (Notts).—For paving, kerbing, channelling, and culverting in Wash-pond-lane, Arnold, for the Arnold Local Board of Health. Quantities by the engineer, Mr. Fredk. Jackson, 18, Low Pavement, Nottingham:—

	Contract No. 1.	Contract No. 2.
F. Haywood, Wortley	£1,082 18 0	£266 5 0
D. Barry, Nottingham	733 11 3	187 3 3
J. Hawley, Ilkeston	596 16 0	163 5 0
H. Vickers, Nottingham	596 0 0	185 0 0
J. Bradley, Lincoln	569 14 0	221 15 0
W. Cordon, Burton Joyce	547 9 6	146 16 0
John Greaves, Front-street, Arnold	518 0 0*	148 0 0*
E. Morris, Arnold	500 0 0	160 0 0
J. Shortland, Nottingham	441 19 6	161 16 0

[Engineer's estimates, 561*l.* 15s. 6d. and 154*l.* 12s. 10d.]
* Accepted.

ASHFORD (Kent).—For the construction of earthenware pipe-sewers, precipitation works, effluent water-tanks, &c., for the Ashford Local Board. Messrs. Jones & Ballard, engineers:—

	A.
W. J. Botterill	£9,894 ..... £270 0 0
R. Nicholson	8,980 ..... 301 18 0
Neave & Co.	8,900 ..... 268 15 0
J. Wood	8,550 ..... 31 0 0
H. Potter	8,400 ..... 350 0 0
G. H. Denne & Son	8,279 ..... 200 15 0
D. F. Beale	7,908 ..... 290 7 0
Davis & Leaney	7,900 ..... 257 0 0
Howland Bros.	7,881 ..... 271 13 0
G. Osenton	7,696 ..... 270 0 0
J. Trollope	7,656 ..... 258 0 0
J. Jackson	7,545 ..... 285 0 0
J. Piper & Son	7,500 ..... 258 0 0
Innes & Wood	7,400 ..... 290 7 7
A. Perry & Co.	7,292 .....
W. & J. Denne	6,943 ..... 200 0 0
T. Reeves	6,777 ..... 182 0 0
G. E. Wallis (accepted)	6,500 ..... 300 0 0

A.—Extra for Doulton's Joints.

BANSTEAD.—For enlarging laundry at the Kensington and Chelsea Schools, Banstead, for the Managers of the Kensington and Chelsea School District. Messrs. A. & C. Harston, architects, 15, Leadenhall-street, E.C. Quantities not supplied:—

Flew & Co.	£250 0 0
Barton & Son	248 0 0
Woodhouse	230 10 0
Cogswell	215 0 0
Newton & Idle	207 0 0
Lye	197 0 0
Balchin & Shopland	179 0 0
Turtle	175 0 0
Potter	158 0 0
Wm. Taylor, Banstead (accepted)	135 0 0

BARNET.—For completing two residential villas on the Lyonsdowne Estate, New Barnet, for Mr. T. B. Mee. Mr. D. Henry North, architect:—

Exton & Burton, Birkbeck Works, Kingsland (accepted)	£1,385 0 0

[No competition.]

BATTERSEA.—For re-constructing a 3 ft. 6 in. by 2 ft. brick sewer, and other works, in New-road, Battersea, for the Board of Works for the Wandsworth District. Mr. J. T. Pilditch, surveyor:—

Hindle & Morrish	£3,698 0 0
Cooke & Co.	3,254 0 0
E. & W. Iles	3,117 0 0
J. King	3,100 0 0
Dickenson	2,750 0 0
McKenzie	2,702 10 0
Kellett	2,539 0 0
Marshall	2,444 0 0
Mayo	2,305 0 0
Pizzey	2,190 0 0
Harris	2,175 0 0
G. Neal	1,980 0 0
Killingback	1,900 0 0
J. Mears	1,795 0 0

[Surveyor's estimate, 2,923*l.*]

BELLAGIO (Surrey).—For the erection of bungalows at Hill-crest, Bellagio, near East Grinstead, Surrey, for Mr. Arthur Burr. Mr. Walter J. Ebbetts, F.R.I.B.A., architect, Savoy House, 115, Strand, W.C.:—

Tenders submitted by Mr. Henry Baylis, builder, Highbury.

	A.	B.
No. 1 Bungalow	£180	—
,, 2 ,,	275	£295*
,, 3 ,,	340	360*
,, 4 ,,	390	425
,, 4A ,,	455	475*
,, 5 ,,	305	325*
,, 6 ,,	300	315

* Accepted.

BELLAGIO (Surrey).—For the erection of a bungalow at Furzefield Chase, Bellagio, near East Grinstead, Surrey, for Mr. J. H. Mackay. Mr. Walter J. Ebbetts, architect:—

H. Baylis	£423 0 0

BLACKHEATH.—For alterations and additions to the Three Tuns, Blackheath, for Mr. F. Walton. Mr. John Jas. Downes, architect, 183, Lewisham High-road:—

Scholfield	£750 0 0
H. L. Holloway	740 0 0
Lorden & Sons (accepted)	650 0 0

CHELSEA.—For the erection of two studios at St. Leonard's-terrace, for Messrs. Cocks & Elsworthy (design No. 2). Mr. Walter J. Ebbetts, F.R.I.B.A., architect, Savoy House, 115, Strand, W.C.:—

H. Baylis (accepted)	£615 0 0

CHESTER-LE-STREET (Durham). — For erecting block of offices and cottages, near The Hermitage, for Mr. Lindsay Wood. Mr. H. T. Gradon, architect, Durham. Quantities by Mr. G. D. Irwin, Sunderland:—

Tremble & Co., Hetton-le-Hole	£1,452 8 0
Haswell & Waugh, Gateshead	1,441 12 4
Atkin & Co., South Shields	1,397 0 0
Gradon & Son, Durham	1,382 3 0
Wm. Thompson, Chester-le-Street	1,365 0 0
G. H. Bell, Bishop Auckland	1,360 8 0
Jaspar Kell, Birmingham	1,360 0 0
Geo. Douglass, Sunderland	1,354 0 0
Wm. Lodge, Plawsworth	1,337 8 0
Thompson & Son, Chester-le-Street	1,334 2 0
W. C. Atkinson, Stockton-on-Tees	1,326 0 0
Robson & Son, Chester-le-Street	1,322 6 0
R. Sanderson, Birmingham	1,320 0 0
John Jopling, Chester-le-Street	1,305 5 0
Wm. Foster, Croxdale	1,300 0 0
Thos. Akenhead, Stamfordham	1,293 3 0
Thos. Wood, Jarrow-on-Tyne	1,231 13 0
John G. Kilburn, South Shields	1,217 0 0
John Jennings, Chester-le-Street	1,123 0 0

CLAPTON.—For additions and alterations, consisting of new assembly-room, studio, class-rooms, lavatories, &c., at the High School for Girls, Marriott-terrace, Clapton, for the Girls' Public Day School Company (Limited). Mr. J. Osborne Smith, architect, 34, Southampton-street, Strand. Quantities by Mr. F. H. A. Hardcastle:—

J. J. Greenwood	£2,775 0 0
W. Gregor	2,722 0 0
M. Manley	2,583 0 0
Wall Bros.	2,497 0 0
J. Bentley	2,350 0 0
Exton & Barton	2,297 0 0
Barrett & Tower, Hackney*	2,283 0 0
Dove Bros.†	1,875 0 0

* Accepted. † Withdrawn.

DEPTFORD.—For alterations and additions to No. 50, New King-street, Deptford, for Mrs. Freak. Mr. John Jas. Downes, architect, 183, Lewisham High-road:—

Martin	£360 0 0
Blaker (accepted)	209 10 0

DEPTFORD.—For repairs and sanitary work to ten houses, Wotton-place, Mill-lane, Deptford, for Mrs. Longinotto. Mr. John Jas. Downes, architect:—

Allwright	£125 0 0
S. Best	95 0 0
Blaker (accepted)	73 0 0

DEPTFORD.—For alterations and repairs to a warehouse, Tanner's-hill, Deptford, for Messrs. J. F. A. Dandridge. Mr. John Jas. Downes, architect:—

H. L. Holloway	£100 0 0

EYE (Suffolk).—For new farm and other buildings at the Kerrison Thorndon Reformatory, Eye, Suffolk, for the Managing Committee. Mr. Frank Whitmore, architect, Chelmsford:—

A. Diss, Colchester (accepted)	£700 0 0

HASTINGS.—For restaurant and bar-fittings at the Palace Hotel. Mr. Arthur Wells, architect:—

Smee & Co., Finsbury-pavement	£1,389 0 0
Taylor Bros., Hastings	1,375 0 0
C. Hughes, St. Leonards	1,360 0 0
G. Vigor, Hastings	1,293 0 0
Sanders & Son, New Oxford-street	1,279 14 0
Sage & Co., Gray's Inn-road	1,175 13 0
J. Walker, Poplar	975 0 0
H. E. Cruttenden, St. Leonards	967 0 0
T. Salter, St. Leonards (accepted)	940 0 0
Pewterer's Work.	
Sanders & Son, New Oxford-street*	186 0 0

* Accepted.

KENSAL GREEN.—For the erection of two shops, Kensal Green, W., for Mr. J. Welford. Messrs. Raymond & Webbe, architects, 16, Rundell-road, W.:—

Martin Wells & Co.	£1,400 0 0
W. Oldrey & Co.	1,225 0 0
F. T. Chinchen, Kensal Green*	1,200 0 0

* Accepted.

KENSINGTON.—For additions, alterations, and sanitary works (exclusive of decoration), at 107, Holland-road, for Mr. James Caldwell. Mr. Edward Tidman, C.E., architect and surveyor, Connaught Mansions, Victoria-street, Westminster, S.W.:—

Giles Bennett	£285 0 0
Harrison & Son	259 0 0
T. A. Owers	256 0 0
H. J. Ball & Co. (accepted)	240 0 0

LIVERPOOL.—For the erection of the Stanley Park Baptist Church, Walton-lane. Mr. Frederick H. Peate, architect, &c., 11, South Castle-street. Quantities supplied:—

Ed. Blackburn	£6,360 1 6
Ed. Bostock	5,564 0 0
Thos. Tyson	5,199 0 0
Morrison & Sons	5,100 0 0
W. H. Clark	5,050 0 0
Richd. Oates	4,992 0 0
Bell & Burnie	4,804 0 0
J. & G. Chappell	4,725 0 0
Thos. Bridge, jun., & Co.	4,697 0 0
Brown & Backhouse	4,638 0 0
Thomas Urmson	4,633 0 0
Nicholson & Clarke	4,600 0 0
Geo. Woods & Sons	4,600 0 0
Hughes & Stirling*	4,590 0 0
Not signed	4,580 0 0
Wm. Thornton & Sons	4,575 0 0
Wm. & J. Caird†	4,573 18 6
Raffles & Campbell	4,550 19 6
Edmund Gabbutt	4,528 0 0
Thomas Spencer*	4,495 0 0

* Not on form of Tender.
† Accepted, with deductions.

[Architect's competition estimate, design B (since which many alterations and additions have been made), 4,300*l.*]

[All of Liverpool and district.]

LONDON.—For erecting the new City of London Court, Guildhall-yard and Basinghall-street. Mr. Andrew Murray, architect, Guildhall. Quantities by Messrs. R. L. Curtis & Sons, 119 and 120, London-wall, E.C., and Mr. Frederick Thomson, 5, Great James-street, W.C.:—

	In Bath Stone.	Extra if in Portland Stone.	Total.
Lawrence	£16,900	£1,405	£18,305
Conder	16,840	1,320	18,160
Grover	16,800	1,340	18,140
Colls	16,440	1,400	17,840
Boyce	15,973	1,000	16,973
Patman & Fotheringham	15,000	950	15,950
Cubitt	14,835	1,100	15,935
Trollope	13,586	2,263	15,849
Chappell	14,539	1,140	15,679
Ashby & Horner	14,530	1,045	15,575
Holland & Hannen	14,300	980	15,280
Scrivener	14,110	1,085	15,195
Perry	13,584	1,100	14,684
Nightingale	13,520	1,000	15,520
Gentry	13,475	950	14,425
Mowlem	13,425	974	14,399
Morter (accepted)	12,827	810	13,637

LONDON.—For alterations and repairs at the Queen's Head, 405, Strand, for Mr. J. Swinyard. Mr. Edward Clark, architect, 432, West Strand. Quantities by the architect:—

Wm. Smith	£575 0 0
T. L. Green	425 0 0
Wilkinson Bros.	425 0 0
A. Hood	415 0 0
Grover & Co.	405 0 0
John Anley	392 0 0
Bishop Bros. & Marston	290 0 0

LONDON.—For rebuilding the Britannia beer-house, Cambridge-road, E., for Miss M. A. Peron. Mr. Edward Clark, architect, 432, West Strand. Quantities by the architect:—

Wm. Smith	£1,095 0 0
T. L. Green	979 0 0
John Anley	926 0 0
John Beale	918 0 0
Bishop Bros. & Marston	865 0 0
J. O. Richardson	853 0 0
A. Hood	748 0 0

LONDON.—For repairs, &c., at No. 7, Sergeants' Inn, E.C., for Dr. R. W. T. Brooks. Mr. Edward Clark, architect, 432, West Strand:—

S. Charlton	£175 10 0
F. White	150 0 0
T. L. Green	137 0 0
Bishop Bros. & Marston (accepted)	89 0 0

LONDON.—For repairs, &c., at 210, Strand, for Mr. Loewenstark. Mr. Edward Clark, architect, 432, West Strand:—

T. L. Green	£137	0	0
John Anley	130	0	0
Bishop Bros. & Marston	112	0	0
F. White	90	0	0

LONDON.—For the erection of warehouse, Newington-causeway, for Mr. S. P. Catterson:—

R. G. Battley	£2,150	0	0
W. & F. Croaker (accepted)	2,040	0	0

LONDON.—For proposed residence and stables, at No. 18, Notting Hill-square, for Mr. A. W. Tuer. Mr. J. T. Newman, architect, 2, Fen-court, Fenchurch-street, E.C. Quantities by Messrs. R. L. Curtis & Sons:—

	House.	Stable.	Allowance Old Materials.	Total.
Holland & Hannen	£5,590	£1,435	£80	£6,945
B. E. Nightingale	4,998	1,284	10	6,272
Bywaters	4,890	1,220	161	5,949
J. Morter	4,733	1,180	50	5,863
Lawrance & Sons	4,714	1,120	60	5,774
Gregory & Co.	4,579	1,177	—	5,756

LONDON.—For building five shops in St. Clement's-road, Notting Hill, for Mr. A. Taylor. Mr. H. Richardson, architect:—

Lyford, Notting Hill	£649	0	0
Cross, Notting Hill	625	0	0
Dearing & Son, Islington	570	0	0
Billing, Hounslow	469	0	0

TAUNTON.—For erecting Victoria Jubilee Nursing Institute, Taunton and Somerset Hospital. Mr. J. Houghton Spencer, architect:—

	First Estimate.	Amended Estimate.
Potter, Taunton	£5,180	£3,745
Pollard, Bridgwater	5,168	3,518
Rendell & Son, Taunton	5,100	3,780
Morse & Aspiller, Taunton	5,067	3,650
Templeman, Taunton	4,961	3,350*
Church, Bristol	4,832	3,684
Fox, Taunton	4,823	3,425
Geo. Pollard, Taunton	4,570	3,400
Verrier & Son, Taunton	4,489	3,518
Henry Spiller, Taunton	4,450	3,350
William Gibson, Exeter	4,300	3,300
Beaven, Bristol	4,250	3,500

* Accepted at 3,340*l.*

WINCHESTER.—For the erection of two pairs of semi-detached villas at Kingsgate-street, Winchester, for Mr. J. Cooper. Mr. T. Stopher, architect:—

J. Crook & Sons, Southampton*	£1,697	0	0

* Accepted.

WROTHAM (Kent).—For the erection of three cottages at Borough Green, Wrotham, Kent, for Mr. John A. Arnold. Mr. H. Hardwicke Langston, architect, 9, Great James-street, Bedford-row, London. Quantities not supplied:—

Falkner, London	£896	0	0
Leonard, Ightam	649	0	0
Burgess & Langridge, Snodland	524	10	0
Bishop Bros., Birling	498	10	0
Semark, Borough Green	450	0	0

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